ARCHIVES

OF

OPHTHALMOLOGY

39209

EDITED IN ENGLISH AND GERMAN

BY

DR. H. KNAPP
OF NEW YORK

AND

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OF BERLIN

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OF NEW YORK
ASSISTANT EDITOR

VOLUME XX

NEW YORK
G. P. PUTNAM'S SONS, 27 & 29 WEST 23D STREET
LONDON: 27 KING WILLIAM STREET, STRAND
WIESBADEN: J. F. BERGMANN'S Verlag
PARIS: J. B. BAILLIÈRE, 19 Rue Hautefeuille
1891

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BY
G. P. PUTNAM'S SONS

Press of
G. P. Putnam's Sons
New York

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ARCHIVES OF OPHTHALMOLOGY

NOTICE TO OUR READERS.

The ARCHIVES OF OPHTHALMOLOGY contain *original papers* on all branches of ophthalmic surgery, and *original reports* on the progress of ophthalmology. The original papers occupy from two thirds to three fourths of the space, and their scope embraces all subjects of scientific and practical interest connected with this department of medicine.

The object of the ARCHIVES is to guard, solidify, extend, and diffuse the stock of acquired ophthalmic knowledge by recording the constant addition of new observations, investigations, methods and means of examination, clinical experience, instruments and remedies, and further by taking part in the discussion of the questions of the day with a spirit alike conservative and progressive.

Particular attention is paid to the preparation of the Report on the Progress of Ophthalmology. The report is intended to furnish a *complete, systematic, and early* review of the current ophthalmological literature of the world. It has been necessary to divide the work of its preparation among a number of collaborators according to the following arrangement :

Dr. ST. BERNHEIMER, of Heidelberg.

1. *General Ophthalmological Literature :*
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   b.—Monographs and papers on historical, statistical, and general subjects ; reports on societies and hospitals.
   c.—Periodicals on our specialty (short notices of their character, time and place of publication, the titles of the original papers, with the names of their authors).

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2. *Eyelids.*
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In the interest of our readers, who are scattered over the whole world—and whom, like ourselves, we desire to keep informed of all advances in ophthalmology,—furthermore in their own interest, authors of ophthalmological works are requested to send reprints, duplicates of journals, or copies for reviewing, to one of the above-named reporters, or to the editors or publishers of the Archives, according to their convenience.

The abstracts of American ophthalmological literature formerly appeared under a special head, but are now embodied in the systematic Report. Text-books may be specially noticed.

The number of good papers offered us for publication has increased to such an extent that it is no longer possible to translate all of them unabridged. Whenever a German paper is condensed in the English version, or *vice versa*, it will be so stated. Should any one of our readers wish to recur to the original, the editors will always take pleasure in sending it for reference.

Under the heading of "Miscellaneous Notes," there will be published all kinds of professional news which specially concern the oculist, *e. g.*, appointments, honors, resignations, vacancies, new ophthalmic hospitals, opportunities for instruction, prize questions and essays, announcement of Society meetings, etc. Brief notices of this kind will be thankfully received by the editors.

Original papers of value from any source will, as heretofore, be welcome to the ARCHIVES, and are solicited.

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NOTICE TO CONTRIBUTORS.

The editors and publishers of the ARCHIVES beg to offer some suggestions to authors who propose to favor them with their contributions.

1. As original communications the ARCHIVES can accept only such papers as have never been printed nor are intended to be printed in other journals. If a preliminary communication on the subject of a paper has been published, the author is requested to state this in the letter accompanying his manuscript. It is understood that contributors to these ARCHIVES and editors of other periodicals will make no abstracts of the original papers published in this journal without giving it due credit for the same.

2. Authors will receive gratuitously twenty-five reprints of their articles. If a greater number is desired,—notice of which should be given at the head of the manuscript,—only the additional cost of presswork and paper will be charged to the author.

3. In preparing manuscript for the compositor it is requested that the following rules be adhered to:

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b. Write without breaks, *i. e.* do not begin a new sentence on a new line. When you want to begin a new line or paragraph at a given word, place before it in your MS. the sign ¶.

c. Draw a line along the margin of such paragraphs as should be printed in smaller type—for instance, all that is clinical history in reports of cases, etc.

d. Words to be printed in *italics*, should be underscored once, in SMALL CAPITALS twice, in LARGE CAPITALS three times.

4. Authors may receive proofs for revision if they will kindly return them without delay. We beg however to remind our contributors that changes in the copy are equivalent to resetting, causing so much additional expense. We therefore request them, to make, if possible, no alterations at all in their MSS., or, at least, to limit these to what is of essential importance

ARCHIVES OF OTOLOGY

PROSPECTUS

To answer questions often addressed to the editors and publishers of the subjoined periodical, we reprint as a Prospectus the Preface to Volume Twenty of the

ARCHIVES OF OTOLOGY

EDITED IN ENGLISH AND GERMAN

BY

DR. HERMAN KNAPP
AND
DR. D. B. ST. JOHN ROOSA,
OF NEW YORK.

DR. S. MOOS,
OF HEIDELBERG.
DR. URBAN PRITCHARD,
OF LONDON.

IN CONJUNCTION WITH

Dr. CRESWELL BAKER, of Brighton, Eng.; Dr. THOMAS BARR, of Glasgow; Dr. A. BARTH, of Berlin; Prof. E. BERTHOLD, of Königsberg; Dr. G. BRUNNER, of Zurich; Dr. SWAN M. BURNETT, of Washington; Sir W. B. DALBY, of London; Dr. E. FRÄNKEL, of Hamburg; Prof. J. GOTTSTEIN, of Breslau; Dr. E. GRUENING, of New York; Prof. A. GUYE, of Amsterdam; Dr. A. HARTMANN, of Berlin; Dr. A. HEDINGER, of Stuttgart; Dr. C. J. KIPP, of Newark, N. J.; Dr. B. LOEWENBERG, of Paris; Dr. F. M. PIERCE, of Manchester; Prof. E. DE ROSSI, of Rome; Dr. JAS. A. SPALDING, of Portland, Me.; Prof. H. STEINBRÜGGE, of Giessen; Dr. E. TRUCKENBROD, of Hamburg; Dr. O. WOLF, of Frankfort-on-the-Main; Prof. R. WREDEN, of St. Petersburg; and many others.

It may be opportune to introduce the twentieth volume of the above periodical with a few prefatory remarks. Dr. Thos. Barr, as president of the Otological Section of the British Medical

Association, at its Glasgow meeting in 1888, suggested "that it would be well if there were an **English editor** of the ARCHIVES OF OTOLOGY in the contributions to which it would also be desirable that British otologists took a larger share." The editors of the ARCHIVES were but too happy to act on this suggestion. On Dr. Barr's proposition they invited Dr. Urb. Pritchard to join them in conducting the ARCHIVES, and they congratulate themselves as well as their readers upon Dr. Pritchard's acceptance of the invitation.

GENERAL SCOPE.

The **objects and form of the** ARCHIVES will undergo no change. We intend to publish, as heretofore, original articles on all topics connected with the theory and practice of aural surgery, viz., normal and pathological, human and comparative anatomy, physiology, pathology, and therapeutics of the auditory organ. No personal restriction whatsoever is imposed on any author, providing his contribution be instructive, scientifically presented, and not unnecessarily lengthy. We expect, however, that those who favor us with their papers will not publish them, as such, in any other periodical.

Illustrations can, to a certain degree, be executed at the expense of the ARCHIVES; for costly ones the authors will be requested to bear a share of the expense. All drawings should be on separated papers, and their places of insertion indicated in the MSS. Clean pen and ink drawings, double the size desired to be put in the text, are particularly welcome.

Besides papers on the organ of hearing proper, we solicit also communications on such of the **neighboring parts** as are in physiological or pathological relation with the ear; in particular the nasal, pharyngeal, and cranial cavities.

The ARCHIVES will continue to publish quarterly or half yearly **systematic reports on the progress of otology.** These reports will be no clippings from other journals, but all original and specially prepared by competent aurists in different

countries, namely, Barth and Hartmann in Berlin, Pritchard in London, Gellé in Paris, Swan M. Burnett in Washington, and others.

Books of interest will be specially reviewed.

Under the head of **Miscellaneous Notes** we shall publish all kinds of professional and personal news that may interest the aurist, *e. g.*, appointments, honors, resignations, vacancies, positions, new otological hospitals, opportunities for instruction, prize questions and prize essays, announcements of society meetings, obituaries, etc.

Of society proceedings we intend in future to give only brief résumés, so as to inform our readers as early as possible what has been transacted in such meetings, reserving fuller abstracts for our systematic reports when the papers have appeared *in extenso.*

An elaborate **index** of all the original papers, the abstracts in the systematic reports, and the miscellaneous otological notes will conclude each volume.

In this way we intend to keep our readers informed of all that is published and done in our specialty, thereby to assist them in their studies, their practice, and their investigations.

All contributions should be addressed to one of the editors, business questions to the publishers.

Papers published in the English edition will be **translated** as soon as possible, to appear in the German edition, and *vice versa.* Should any one of our subscribers wish to refer to the original of a translated paper, it will be sent to him on application to one of the editors. When it is necessary to condense a paper, it will be so stated.

The English edition appears in quarterly numbers, four to make a volume of from 300 to 350 pages each year. The German edition issues its numbers irregularly, according as the material comes in. For this reason the volumes of one edition do not agree with those of the other. The plates, being used for both editions, cannot follow in the same order in each, but a special

statement at the head of each translation will indicate to which paper they belong.

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Contributors to the English edition receive no honorarium for authorship, but twenty-five reprints free of charge, and a greater number at the cost of paper and printing, if such a demand is made at the head of the MS.

The **subscription price** of the ARCHIVES OF OTOLOGY will be $3 (12 shillings) per vol. Single numbers may be had at $1.00 (4 shillings). Postage (for Great Britain) 3*d.* per number.

The price of the *Archives of Ophthalmology* is $5 (1£) per volume. Single numbers $1 50 (6 shillings). Postage (for Great Britain) 4*d.* per number. After the present year (1891) no reduction will be made on either the English or American editions, for subscriptions to both journals. The price of these together, will be from January, 1892, $8.00 (£1.12.0).

NEW YORK, Jan. 2, 1891.

G. P. PUTNAM'S SONS

27 AND 29 WEST 23D STREET,
NEW YORK.

27 KING WILLIAM STREET,
LONDON.

J. F. BERGMANN, WEISBADEN,
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ARCHIVES OF OPHTHALMOLOGY.

ON THE CYLINDRICAL EQUIVALENT OF TILTED LENSES, THE PRISMATIC EQUIVALENT OF DECENTRED LENSES, AND THE EMPLOYMENT OF SUCH LENSES IN PRACTICE.

By WARD A. HOLDEN, A.M., M.D.,
ASSISTANT SURGEON N. Y. OPHTHALMIC AND AURAL INSTITUTE.

(*With five drawings.*)

I.—ON THE TILTING OF LENSES.

HISTORY.—Thomas Young, who discovered, measured, and corrected by a cylinder the astigmatism in his own eye, was the first to show that homocentric rays of light passing through a tilted spherical convex lens do not focus in a point, but in two lines perpendicular to each other, and, further, that within certain limits a tilted spherical lens before the eye has the effect of a spherical lens combined with a cylinder. Donders mentioned this principle in 1864 in his "Accommodation and Refraction of the Eye." Javal[1] first used it in practice in 1865. Javal's case was one of aphakia after cataract extraction, in which the cylinder $\frac{1}{16}$ brought the vision from $\frac{1}{4}$ to $\frac{3}{4}$, whereas by careful experiment the tilted spherical alone brought the vision to $\frac{1}{2}$ (Becker). Professor Pickering and Dr. Chas. H. Williams, while making physical experiments, noticed a disturbance when the lenses used were tilted, and, studying the matter thoroughly, found that a *tilted spherical has an increased spherical power as well as a cylindrical effect*. In their paper, "Foci of Obliquely Placed Lenses,"[2] are given two tables, one showing the increased refractive power in the horizontal meridian, the other showing the increased refractive power in the vertical meridian, of a lens tilted a series of angles on a vertical axis. These tables were made by careful experiment and verified by computa-

[1] *Klin. Monatsbl.*, 1865, p. 339.

[2] Trans. American Acad. of Arts and Sciences, 1874–75, p. 300.

tion. Hay, in a paper "On the Increase of Refractive Power of a Plano-Cylindrical Lens when Rotated about its Axis,"[1] gave a formula deduced from one of the formulæ of Pickering and Williams, and explained the increase in refractive power by a diagram. Sous[2] did not accept Hay's explanation, and by a purely geometrical demonstration wished to show that there is not an increase in refractive power, but, on the contrary, a decrease. We shall look over these demonstrations in their order.

For the sake of clearness, with the tables of Pickering and Williams there will be presented also the methods by which they arrived at the formulæ for making the computations. In computing their tables a lens of 25.5 inches focal length was mounted on a rotating stand, and beyond it was placed a sliding screen having a horizontal and a vertical slit with cross hairs. Behind the screen was a gas flame, and a few inches in front of the lens a telescope. The lens was tilted on a vertical axis, the various angles given in columns 1, i indicating the angle of incidence of the rays, and the screen was moved first to the position in which the vertical slit was focused, and then to the position in which the horizontal slit was focused. Taking the focal distance of the lens $F = 100$, and the index of refraction of crown glass $n = 1.5$, column 2, Table I., gives the new focal distances for the vertical slit, and column 2, Table II., the new focal distances for the horizontal slit.

TABLE I.

i	F'	$\frac{df}{dn}$
0°	100	0.0
5°	98.9	0.0
10°	96.1	0.1
15°	91.2	0.2
20°	84.8	0.2
25°	77.	0.3
30°	68.4	0.4
35°	59.2	0.5
40°	49.8	0.6
45°	40.6	0.6
50°	32.	0.6
55°	24.1	0.6
60°	17.1	0.5

TABLE II.

i	F''	$\frac{df}{dn}$
0°	100	0.0
5°	99.9	0.0
10°	99.2	0.2
15°	97.7	0.3
20°	96.1	0.5
25°	93.7	0.6
30°	91.1	0.8
35°	88.3	1.0
40°	84.7	1.2
45°	81.1	1.5
50°	77.2	1.7
55°	73.2	1.9
60°	69.0	2.1

[1] Trans. Amer. Ophth. Society, 1875, p. 319.

[2] "Traité d'Optique," 1881, p. 463.

Extracts from the original paper of Pickering and Williams follow, giving the working formulæ and the steps in their computation.

To represent these results theoretically, let us suppose the slits and lens so small, compared with their distance apart, that we may neglect all aberration except that due to the obliquity of the incidence. Considering first the case of the vertical slit, let Fig. 1

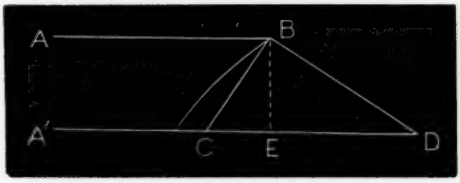


FIG. 1.

represent the section of a horizontal plane passing through the centre of the lens. Then let D represent the position of the slit when the emergent rays are parallel—that is, when A B is parallel to A′ C. Now C D = F′ is the new focal length to be determined. Call F the principal focal distance, n the index of refraction, i and r the angles of incidence and of refraction of the light on entering the lens, and r' and i' the corresponding angles on its emergence. Call also A the angle between the two surfaces of the lens at its edge, or of the two surfaces where pierced by the ray. Then, by the law of refraction, sin i = n sin r, and sin i′ = n sin r′ = n sin (r + A) = n sin r + n A cos r = sin i + n A cos r, since r′ = A + r and sin A, being very small, may be regarded as equal to A. Again, sin i′ − sin i = cos i (i′ − i) = n A cos r, and hence $\frac{i' - i}{A} = \frac{-n \cos r'}{\cos i}$.

Now, in the triangle B C D we have B D C = i − i′ − A, B C D = 90° − i, and B D sensibly equal to F′. Again B C = F A (n − 1), for by the formula for lenses $\frac{1}{F} = (n-1)\left(\frac{1}{R} + \frac{1}{R}\right)$, or $F = \frac{R}{2(n-1)}$, but $A = \frac{2BC}{R}$ ∴ $F = \frac{BC}{A(n-1)}$, or B C = F A (n − 1).

Since the sides are proportional to the sines of the opposite angles B D : B C = sin B C D : sin B D C, or F′ : F A (n − 1) = sin (90° − i) : i − i′ − A, or $F' = F\,\frac{A(n-1)\cos i}{i - i' - A}$. Dividing by

A, and substituting the value of $\frac{i - i'}{A}$ given above, we have

$$F' = F\,\frac{(n-1)\cos^2 i}{n\cos r - \cos i} = F\,\frac{(n-1)\cos^2 i}{\sqrt{n^2 - \sin^2 i} - \cos i} =$$

$$F\,\frac{(n-1)\cos^2 i}{n^2 - 1}\,(\sqrt{n^2 - \sin^2 i} + \cos i) =$$

$$F\,\frac{\cos^2 i}{n+1}\,(\sqrt{n^2 - \sin^2 i} + \cos i).^1 \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

By means of this formula the value of F′ was computed for every 5° for n = 1.5 ; and the results calling F = 100 are given in column 2, Table I. Column 3 gives the rate of change of F for small changes of n or $\frac{df}{dn}$. This is serviceable for computing the foci of lenses of various indices, but it is applicable only for values of *n* near 1.5 or 1.6.

The case of the horizontal slit is more complicated, since the rays no longer remain in one plane. Considering only those rays in the vertical plane passing through the axis around which the lens turns, and one point of the slit, we see that they will strike the lens at an angle of incidence about equal to i, will traverse it in a plane which we will call the plane of refraction, inclined to the first plane i — r, and finally emerge in a plane parallel to the first. The plane of refraction will intersect the lens along two circles, whose distance apart at the centre will be greater than the thickness of the lens in the ratio of cos r to 1 ; hence their radii R′ will be less than the radius of curvature R of the surfaces of the glass in the same ratio, or R′ = R cos r. Again, the apparent index of refraction n′ will be different, and since $\frac{1}{F} = \frac{2(n-1)}{R}$ and $\frac{1}{F'} = \frac{2(n'-1)}{R'}$ we have $F' = F\,\frac{n-1}{n'-1}\cdot\frac{R'}{R}$ $= F\cos r\,\frac{n-1}{n'-1}$. It therefore only remains to determine n′, the apparent index of refraction. As the problem is one in spherical trigonometry, suppose a sphere described around the centre of the lens and projected in Fig. 2, the eye lying in the axis of the lens prolonged. Let C A = i, the angle through which the lens has been turned, and C E = r, the corresponding angle of refraction. Then if the surface of the glass is vertical, as at the centre of the lens, the incident ray will be A C and the refracted ray C E. Next, suppose the surface slightly inclined by the amount C D =

[1] In the original the formula has n — 1 as denominator of its fractional part. This is no doubt a typographical error. Both terms of the fraction in the preceding equation were divided by n — 1. The denominator in the last should therefore be n + 1.

B C = v as is the case for the upper and lower parts of the lens. A B = i′ will now be the angle of incidence ; and to construct the refracted ray, we have first the condition that sin i′ = n sin r′, and secondly, that the incident and refracted rays shall lie in the same plane with the normal B C D. To construct it, pass a plane

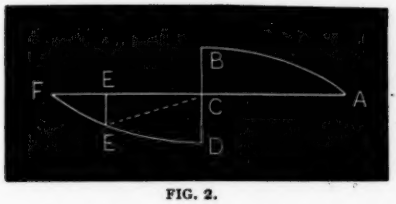


FIG. 2.

through the normal B C and the incident ray A C, which will intersect the sphere along the great circles A B and F D ; on this, lay off D E′ = r′ such that n sin r′ = sin i′, but, as v is infinitesimal, it will be sensibly equal to i, and r′ to r. Now in the right-angled spherical triangle F C D, sin C D = sin D F sin C F D, or sin v = v = sin i × F, or $F = \frac{v}{\sin i}$; and in the triangle F E E′, sin E E′ = sin F E′ sin E F E′ or E E′ = sin (i − r) F, or substituting the value of F just found, $E E' = v \frac{\sin (i - r)}{\sin i}$. Calling i″ and r″ the angles of incidence and refraction of the ray with regard to the section of the lens made by the plane of refraction ; then i″ will not equal B C but will be the angle, which when projected on the plane of the section of the lens, will be B C or i″ cos r − B C $\therefore i'' = \frac{v}{\cos r}$. Again E E′ is the angle through which the ray is bent or $i'' - r'' = v \frac{\sin (i - r)}{\sin i}$ or subtracting

$$r'' = v\left[\frac{1}{\cos r} - \frac{\sin (i - r)}{\sin i}\right] = v \frac{\sin i - \sin (i - r) \cos r}{\sin i \cos r}$$

but $n' = \frac{i''}{r''}$, which with the above values gives

$$n' = \frac{\sin i}{\sin i - \cos r \sin (i - r)}$$

Substituting this value in the equation

$$F' = F \cos r \frac{(n - 1)}{(n' - 1)} \text{ gives}$$

$$F' = F (n' - 1) \frac{\sin i - \sin (i - r) \cos r}{\sin (i - r)}$$

This would be the focal distance if the rays on emerging remained in the plane of the section of the lens. But they pass into

a plane inclined to this i — r, hence the observed focus F'' will be such that when projected on the plane of the section it will equal F', or $F'' \cos (i - r) = F'$. Hence finally

$$F'' = F \frac{\sin i - \sin (i - r) \cos r}{(n - 1) \sin (i - r) \cos (i - r)} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

This last step may be open to criticism, but the close agreement with observation seems to justify it.

Hay gives as a formula, omitting the first term:

$$F \times \frac{\cos 2\varphi}{2(n \cos \varphi' - \cos \varphi)} \text{ in which}$$

F = focal distance of cylinder.
φ = its obliquity.
φ' = the angle of refraction corresponding to angle of incidence φ.
n = the index of refraction about equal to 1.53.

This is deduced from the formula of Pickering and Williams $F' = F \frac{(n-1) \cos^2 i}{n \cos r - \cos i}$, the letters being changed, n being taken as 1.5 and as an equivalent to $n - 1 = .5$ in the numerator, 2 is placed in the denominator. This formula is correct.

Sous gives his demonstration as follows:

Let S be a luminous point situated on the principal axis S S′ of a spherical lens L′, and beyond its focus. That point will have

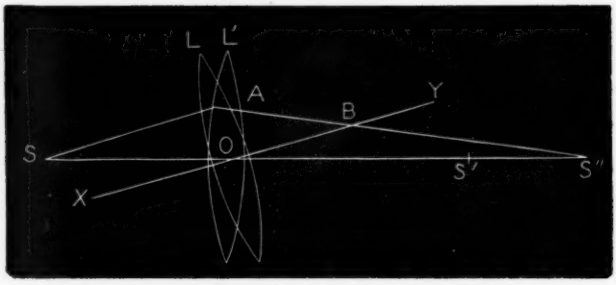


FIG. 3.

its image at the point S′. The relation between the points S and S′, designating S O by p and S′ O by p′, will be

$$\frac{1}{p} + \frac{1}{p'} = \frac{1}{F} \text{ or } p' = \frac{p\,F}{p - F}.$$

If the lens be now tilted until it occupies the position L, the principal axis will be X Y and the point S will be situated on a secondary axis. To find the position of its image draw S A parallel to X Y. That ray passing through the focus B of the lens L will cut the secondary axis at S'' where the image of the point S will be found.

Let us determine the position of the point S'. In the triangle $S'A$ S, O B being parallel to the base S A, we have

$$\frac{O\,B \text{ or } F}{A\,S} = \frac{S'\,O \text{ or } p'}{S'\,O \text{ or } p' + O\,S \text{ or } p},$$

we have also $\frac{A\,S}{O\,S \text{ or } p} = \cos C\,O\,X.$

Transposing into the first equation the value of A S found in the second and designating by α the angle S O X, angle of rotation of the lens, we get for the value of p'', $p'' = \frac{p\,F}{p \cos \alpha - F}$.

Let us compare the two values of p' and p''. Cos α being a functional number less than unity and becoming smaller as the angle is greater, p cos α − F is less than p − F ; p'' is then greater than p'. The point S'' is then farther from the lens than the point S.

There is no positive error in this demonstration *per se*. Any demonstration of this sort employing the usual optical laws and formulæ will give an equally incorrect result. This may be shown in the following manner.

Let F and F' (Fig. 4) be the principal foci of the lens L,

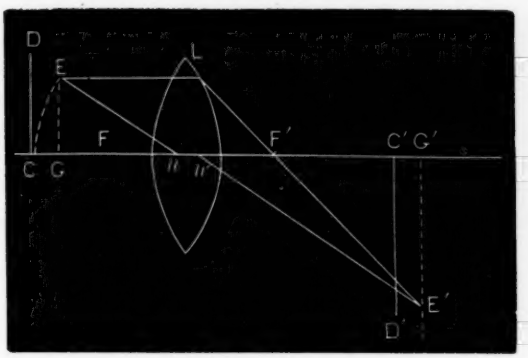


FIG. 4.

and let C and C′ be any pair of conjugate foci. Now consider the lens tilted, or, what is equivalent for our purpose, consider the point C moved from the axis, remaining, however, the same distance from the first nodal point of the lens. Let us suppose it moved to E and E n = C n. The problem now is to find the position of the image of E.

By the optical law the abscissæ of conjugate points outside the axis of a lens are also conjugate. That is, if C and C′ are conjugate foci, any point in the line D C will have its image in the line D′ C′. The abscissa of E is E G. The image of E must then lie at a point whose abscissa will intersect the axis at some point G′ which will be the conjugate focus of G. Now since C and C′ are conjugate foci the conjugate focus of G must lie farther from the lens than C′ at some point as G′. The image of E must lie then in the perpendicular erected on the axis at this point G′. To find the position of the image of E draw a line from E, parallel to the axis, to the second principal plane of the lens and from this through the focus F′, and where this line continued intersects the perpendicular erected at G′ will lie the point E′, the position of the image of E. The new focal distance is then n′ E′. In the figure we have the right-angled triangle n′ G′ E′; n′ E′ being the hypothenuse is greater than n′ G′ a side, and consequently greater than n′ C′ the primary conjugate focal distance. Hence the image of a point outside the axis of a lens lies farther from the lens than the image of an equidistant point on the axis. The refractive power of a lens is then decreased by the tilting.

These demonstrations, with results contrary to physical facts, show that the usual optical methods do not give even approximately correct results in all cases. Diagrams are given in the books for the purpose of showing more or less accurately the relations of various rays before and after refraction by a lens. The formulæ in the books, however, are computed only for rays which form small angles with the axis of the lens, and which emanate from a given point in that axis. These formulæ being applicable to such rays only, cannot be used at pleasure for rays having any relations whatsoever.

Methods of Finding the Effect of Tilting.—The increased refractive power of a tilted spherical convex lens may be determined experimentally with a fair degree of accuracy in the following manner: a disc with a slit receiving the handle of a test lens may be put into the clip of the trial frame and turned. The lens will then be rotated on a horizontal axis. Let the lens first be vertical and place a screen at its focus and a sharp image of a distant flame will be formed. Then tilt the lens the required number of degrees and a blurred image will be produced on the screen. Hold before the tilted convex lens that concave spherical lens and that concave cylinder, or the two concave cylinders, with axes horizontal and vertical, which will render the image sharp. These correcting lenses are the measure of the increased refractive power of the tilted lens. The lessened refractive power of a tilted concave lens may be determined in this manner, by holding before it in the tests a stronger convex spherical, so that an image will be formed on the screen. It will be found that the refractive power is lessened in the tilted concave lens in the same degree that it is increased in the tilted convex lens, consequently the same tables will serve for both. The positions of the new foci may be roughly determined as follows: the emmetropic eye of the observer on looking through the vertical lens will get a clear image of lines on the screen which is placed at the focus of the lens. Let the lens be tilted and all lines appear blurred. When the screen is brought nearer the lens, at some point the vertical lines will appear sharp. This distance from the lens to the screen will be the greater secondary focal distance. When the screen is moved still nearer, the horizontal lines will appear sharp. This distance from the lens to the screen will be the lesser secondary focal distance.

In the tables of Pickering and Williams, the two secondary focal distances have been computed for a single lens tilted at various angles. By means of their formulæ, however, the focal distances may be computed for any lens at any angle. For example, for finding the greater secondary focal distance of the lens $\frac{1}{40}$, tilted 30°, the formula is

$$F' = F(n-1)\frac{\sin i - \sin(i-r)\cos r}{\sin(i-r)\cos(i-r)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

The data are

$$F = 40,$$
$$i = 30°,$$
$$r = 19° 28', \text{ from the formula, } n \sin r = \sin i,$$
$$n = 1.5.$$

Then $F' = 40\,(1.5-1)\,\frac{.5 - .1828 \times .9428}{.1828 \times .9831}$, and

$$F' = 20\,\frac{.3276}{.1797} = 36.44$$

To find the lesser secondary focal distance of the same lens at the same angle, we employ the formula

$$F' = F\,\frac{\cos^2 i}{n+1}\left(\sqrt{r^2 - \sin^2 i} + \cos i\right) \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The data are as before. Then

$$F' = 40\,\frac{(.866)^2}{15+1}\left(\sqrt{(1.5)^2 - (.5)^2} + .866\right),$$

and $F' = 11.99\,(2.286) = 27.4$

After tables such as I. and II. have been computed by means of these formulæ for one lens at various angles, it is a simple matter to get the secondary focal distances for any lens. With a given angle the formula would vary for different lenses only in the value of F. The secondary focal distances of two lenses tilted at the same angle are to each other then as the primary focal distances. We can compute these secondary focal distances for any lens, using Tables I. and II., by a simple proportion. Table I. gives the lesser focal distance for varying angles, taking the primary focal distance F as 100. To find, for example, the lesser secondary focal distance of the lens $\frac{1}{40}$ at 30°, taking 100 from the 0° line and 68.4 from the 30° line of Table I., we have

$$100 : 68.4 :: 40 : F'', \quad 100\,F'' = 2736.0,\ F'' = 27.36.$$

By the formula the value of F'' was found above to be 27.4. In the same manner the greater focal distances of any lens may be computed from Table II. Here follow computed tables of the secondary focal distances of a series of lenses at 10°, 20°, 30°, and 40° inclination.

TABLE III.

INCLINATION, 10°.

Focal length of lens, F	F″	F′
40	39.68	38.4
26	25.79	24.98
20	19.84	19.22
16	15.87	15.37
13	12.89	12.49
10	9.92	9.61
9	8.92	8.64
8	7.93	7.68
7	6.94	6.72
6½	6.44	6.24
6	5.95	5.76
5½	5.45	5.28
5	4.96	4.8
4½	4.46	4.32
4	3.96	3.84
3½	3.47	3.36
3	2.97	2.88
2½	2.48	2.40

TABLE IV.

INCLINATION, 20°.

Focal length of lens, F	F″	F′
40	38.4	35.92
26	24.98	21.04
20	19.22	16.96
16	15.37	13.56
13	12.49	11.02
10	9.61	8.48
9	8.64	7.63
8	7.68	6.78
7	6.72	5.93
6½	6.24	5.51
6	5.76	5.08
5½	5.28	4.66
5	4.80	4.24
4½	4.32	3.81
4	3.84	3.39
3½	3.36	2.96
3	2.88	2.54
2½	2.40	2.12

TABLE V.

INCLINATION, 30°.

Focal length of lens, F	F″	F′
40	36.44	27.36
26	23.68	17.78
20	18.22	13.68
16	14.57	10.94
13	11.84	8.89
10	9.11	6.84
9	8.19	6.15
8	7.28	5.47
7	6.37	4.78
6½	5.92	4.44
6	5.46	4.10
5½	5.01	3.86
5	4.55	3.42
4½	4.09	3.07
4	3.64	2.65
3½	3.18	2.39
3	2.73	2.05
2½	2.27	1.71

TABLE VI.

INCLINATION, 40°.

Focal length of lens, F	F″	F′
40	33.88	19.92
26	21.02	12.94
20	16.94	9.96
16	13.55	7.96
13	11.01	6.47
10	8.47	4.98
9	7.62	4.48
8	6.77	3.98
7	5.92	3.48
6½	5.50	3.23
6	5.08	2.98
5½	4.65	2.73
5	4.23	2.49
4½	3.81	2.24
4	3.38	1.99
3½	2.86	1.74
3	2.54	1.49
2½	2.11	1.24

The Applications of the Principle.

The practical points on which this subject bears are four, viz.: the wearing of tilted spherical glasses for the correction of ordinary compound astigmatism; the wearing of tilted sphericals in cases of aphakia with astigmatism; the change in the refractive power of the ophthalmoscope lenses when the instrument is tilted; and the change of refractive power in the convex lens behind the tilted otoscope mirror in examination of the membrana tympani.

The Tilting of Spectacle Lenses.—With regard to the first point, it is impracticable in ordinary compound astigmatism to tilt the glasses more than 20°, and then only on a horizontal axis. If, however, in compound hyperopic astigmatism, the cylinder is placed with its axis horizontal, which is not often the case, the correction may at times be made with a tilted spherical glass. If the refraction of the vertical and of the horizontal meridian corresponds to the reciprocals of two numbers in the same horizontal line in columns 2 and 3 of Tables III. or IV., or nearly corresponds to them, we can hope to make the correction by tilting a spherical lens of the focal length given in column 1 at the angle given above the table. For example, with the refraction of one meridian $\frac{1}{9.6}$ and of the other $\frac{1}{8.4}$ (line 6, Table IV.), or approximately accepting a spherical $\frac{1}{9.5}$ and a cylinder $\frac{1}{72}$, the correction can be made by tilting a $\frac{1}{10}$ lens 20°. In cases of compound myopic astigmatism, in which the axis of the cylinder is usually horizontal, the correction may often be made by tilting if the myopia is of considerable degree and the astigmatism proportionately slight.

The spherical lens tilted on a horizontal axis has the disadvantage that the refractive error is corrected only while the eye remains in a given horizontal plane. Suppose the upper edge of the glass tilted from the patient. Then if he look through the lower part of the glass, the visual axis of the eye comes to form a smaller angle with the axis of the lens, and the effect of the tilting is correspondingly lost. If he look through the upper part of the glass, the visual axis

is at a greater angle with the axis of the lens, and the refractive power is increased. For this reason tilted spherical glasses are less adapted for distance than for reading.

In the astigmatism following cataract extraction the meridian of greatest refraction is in the direction of the line joining the puncture and counter-puncture made by the knife in the section of the cornea.[1] If the base of the corneal flap be horizontal, the axis of the correcting cylinder must be placed horizontal. If the base of the flap be inclined at an angle with the horizontal, the axis of the cylinder must be correspondingly inclined. Inasmuch as the axis of the cylinder is always horizontal or nearly so, the tilted spherical may be used to make the correction, provided that the astigmatism be not of high degree. Here follow tables showing the change in refraction of the lenses most used in aphakia, when tilted 10°, 15°, and 20°. The increase in spherical effect in the strongest lens at the greatest angle, *i. e.*, a lens of 2¼-inch focal distance tilted 20°, is only $\frac{1}{64}$. This increase is so slight in comparison with the strength of the lens (the spherical effect here would be 2⅜ instead of 2¼) that it may be practically neglected. The tilted lens may then be considered as having only the spherical effect equal to the reciprocal of the number given in column 1. Column 3 gives the differences between the refractive powers of the horizontal and vertical meridians, *i. e.*, the cylindrical effect of the tilted lens. Column 4 gives the test-case glasses in inches corresponding nearest to the cylindrical effects given in column 3. In practice, then, column 4 gives the cylindrical effect produced by tilting the corresponding spherical in column 1, at the angle given above the table.

FOR 10° OF TILTING.

1. Sphericals in inches.	2. New focal distances.	3. Cylindrical effect.	4. Nearest corresponding test-glass.
4½	4.46–4.32	$\frac{1}{140}$	160
4	3.96–3.84	$\frac{1}{124}$	80
3½	3.47–3.36	$\frac{1}{108}$	80

[1] Haase, *Wiesbaden klin. Beobachtungen*, iii., p. 116.

1. Sphericals in inches.	2. New focal distances.	3. Cylindrical effect.	4. Nearest corresponding test-glass.
3½	3.22–3.12	1/100	80
3	2.97–2.88	1/88	80
2¾	2.72–2.64	1/80	80
2½	2.48–2.40	1/74	80
2¼	2.23–2.16	1/68	80

FOR 15° OF TILTING.

1. Sphericals in inches.	2. New focal distances.	3. Cylindrical effect.	4. Nearest corresponding test-glass.
4½	4.39–4.10	1/68	52
4	3.90–3.64	1/64	52
3½	3.41–3.19	1/60	52
3¼	3.17–2.96	1/56	40
3	2.93–2.73	1/52	40
2¾	2.68–2.50	1/47	40
2½	2.44–2.28	1/44	32
2¼	2.19–2.05	1/38	32

FOR 20° OF TILTING.

1. Sphericals in inches.	2. New focal distances.	3. Cylindrical effect.	4. Nearest corresponding test-glass.
4½	4.32–3.81	1/40	40
4	3.84–3.39	1/38	26
3½	3.36–2.96	1/34	26
3¼	3.12–2.75	1/32	22
3	2.88–2.54	1/31	22
2¾	2.64–2.33	1/29	20
2½	2.40–2.12	1/28	18
2¼	2.16–1.90	1/25	16

For a simple working table we may combine these three:

Sphericals in inches.	Test-case glass in inches corresponding to cylindrical effect of tilting.		
	10°.	15°.	20°.
4½	160+	52—	40
4	180+	52+	26—
3½	80—	52+	26+
3¼	80—	40—	22—
3	80—	40+	22+
2¾	80—	40+	20+
2½	80+	32—	18
2¼	80+	32	16+

The aphakic eye is probably practically the only one with which tilted sphericals would be much used in practice. As to the range of application, the paper of Scimemi[1] gives us the necessary data. He examined with the ophthalmometer of Javal and Schiötz, 146 eyes from which cataracts had been extracted. He found the horizontal diameter of the cornea lessened in length, and the vertical diameter increased in length after the extraction, the refraction being then less in the vertical meridian than in the horizontal. This astigmatism is then contrary to the usual corneal astigmatism, and may correct it.

The amount of astigmatism is markedly increased by accidents in and following the operation, such as prolapse of vitreous, iris, or lens capsule, enlargement of the section by the scissors, opening of the wound on a later day, or suppuration in it; the amount varies, also, according to the section and the manner of extraction used. In general he found the astigmatism, one month after the extraction, rarely as great as 3 *D*. The amount then present decreased until the second or third month, at which time it becomes permanent.

The Tilting of the Ophthalmoscope.—It might be supposed that the usual increase in refraction in tilted sphericals, would be influenced in the case of the ophthalmoscope, by the fact that the rays must pass through two small apertures —the perforation in the instrument, and the pupil of the observer. But the increase in refraction is the same here as elsewhere. It is easy to convince one's self by trial with the tilted ophthalmoscope, that the distances at which horizontal and vertical lines are clearly seen, are those given in the tables, for that lens and angle of inclination. This concerns the question of the tilting mirror. Loring, one of the chief advocates of the tilting mirror, says:[2] "In regard to the advantage of a mirror set at an angle for the use of the upright image, there can be no possible doubt in the mind of any one who has once seen the difference, in

[1] Scimemi: "Sull' astigmatico corneale in seguito ad estrazione di cateratta." *Annali di Ottalmologia*, p. 299, 1889.
[2] "Ophthalmoscopy," p. 249.

the ease of illumination and the clearness and brilliancy of the picture. By its use, a large quantity of light is saved, since the correcting glass, instead of being at a considerable angle with the axis of vision, and, therefore, in a position favorable to a largely increased loss of light through reflection from the surface of the glass, is nearly at right angles to it, by which all the light possible is saved." This explanation of the reason for the loss of light is manifestly incorrect. Jaques,[1] in a paper on "Light Transmitted by One or More Plates of Glass," has shown that if a given illumination be taken as 100, the amount of light transmitted through one glass plate is 89.5 when the glass is perpendicular to the axial ray, 89.5 when the glass is tilted 10°, 88.5 when tilted 30°, and 86.3 when tilted 45°, the amount of light lost by tilting being infinitesimal. With two glasses in the primary position, the transmitted light is 81, and the amount lost by tilting is very small. The brightness of the image, with the ophthalmoscope tilted, is diminished, not because the lenses are inclined, it being diminished almost as much when there is no lens before the perforation; but because a smaller number of rays reach the eye through the oblique perforation, whose size as regards the plane perpendicular to the visual axis, has become smaller. This, however, is a matter of little importance. If the position of the light is correct, the ophthalmoscope need never be tilted an appreciable amount. The principal cause of the greater brilliancy and clearness of the picture that Loring found, is, that when both instruments are held very near the examined eye, the tilted mirror receives light on a greater portion of its surface than the fixed mirror, and more light is thrown into the eye. The tilting mirror has the advantage that the instrument having it may be held nearer the examined eye than the instrument with a fixed mirror, and still furnish a sufficient illumination. If, however, the light be placed properly, that is, so that the rays fall on the external margin of the orbit, and are not cut off from it by the cheek—and if the observer's eye be so placed as to bring it as near as is practicable into line with the light and

[1] Proceed. American Acad. of Arts and Sciences, 1874–75, p. 339.

the examined eye, an ophthalmoscope with a fixed mirror will furnish a good illumination, and will not be tilted an appreciable amount. It may be necessary to hold it a little farther from the eye than an instrument with a tilting mirror, but this distance may be allowed for in estimating the refraction, and the observer may be sure that the lenses are looked through squarely, and that they have only the refractive power that is marked on the instrument. With a tilting mirror, little attention is given to the position of the light; and the instrument being held as near the eye as possible, is often unconsciously so tilted that a marked cylindrical effect is produced; and vessels running in one direction appear sharp, while those at right angles appear blurred, in cases of simple hyperopia or myopia. In refraction tests, the position of the light is more important than the position of the mirror. With a properly placed light, *i.e.*, $1\frac{1}{2}' - 2'$ behind the patient, as accurate a result may be obtained with the fixed mirror as with the tilted mirror. The tilting mirror complicates the instrument and is inconvenient, while it would not seem to have the decided advantages that it is supposed to possess.

With cylindrical lenses in the ophthalmoscope, when the axis of the cylinder is horizontal, no increase in refraction will be caused by tilting the instrument. When the axis is vertical, tilting will cause an increase in the refractive power, and the new focal distance of the cylinder may be found in column F′ of the table for that angle, opposite the number in column F which is equal to the focal length of the cylinder.

The Tilting of the Otoscope Mirror.—For the examination of the membrana tympani many aurists place a $+\frac{1}{10}$ spherical lens behind the perforation in the otoscope mirror. Since the light comes from behind the patient's head, the reflected rays from the mirror form an angle with the incident rays of from 20° to 40°. The mirror must then be tilted at an angle of from 10° to 20°. If it be tilted 20° the increased refractive effect of the lens is such that the mirror must be brought from 10 inches, its usual distance from the membrana tympani, to 9.6 inches before vertical lines can be seen

sharply, and to 8.5 inches before horizontal lines can be seen sharply, and at no distance will the eye have a clear image of the membrane. The cylindrical effect of a $+\frac{1}{10}$ spherical tilted 20° is $\frac{1}{8.48} - \frac{1}{9.61} = \frac{1}{72}$. The cylindrical effect when tilted 10° is $\frac{1}{9.61} - \frac{1}{9.92} = \frac{1}{309}$. A $\frac{1}{160}$ cylinder with the $\frac{1}{10}$ spherical will not lessen the sharpness of an image, a $\frac{1}{80}$ cylinder will lessen it materially. Placing then a $\frac{1}{160}$ concave cylinder, with axis vertical, in combination with the $+\frac{1}{10}$ spherical, the cylindrical effect will be less than $\frac{1}{160}$ at every angle of inclination between 0° and 20°, and a clear image will be obtained for all distances under 9.6 inches.

With a simple spherical lens behind the mirror, the position of the light and the inclination of the auditory canal are of importance, and the smaller the angle between incident and reflected rays, the less is the mirror tilted and the sharper will be the detail of the image seen.

Recognizing the considerable cylindrical effect of tilted spherical lenses, it is evident that in order to obtain a maximum of vision in patients wearing spherical lenses, care must be taken to have the lenses in a plane perpendicular to the visual axis, which plane for distant vision is not the same as that for reading.

II.—ON THE DECENTRING OF LENSES.

We may complete the study of the subject of spectacle lenses with axes not coinciding with the visual axes, by considering the decentring of lenses for prismatic effect, in which case the lens undergoes a lateral or vertical displacement, while its axis remains parallel to the visual axis. Late text-books have given this subject a closer attention than the bare mention of the fact that decentring a lens produces deviation of the rays passing through it. Maddox[1] gives a table adapted from an earlier thesis, showing the prismatic effect of decentring any lens, the table being computed by means of the formula $\tan x = \frac{d}{f}$, which we shall consider

[1] "The Clinical Use of Prisms; and the Decentring of Lenses," London, 1889, p. 49.

later. Berry[1] gives a demonstration of the deviation, and also a formula for computing it, $d = f \tan \Delta$, which is identical with that of Maddox.[2]

It is possible, however, to demonstrate this deviation very simply, and to make formulæ so condensed and so easy of application that they may be readily employed in practice.

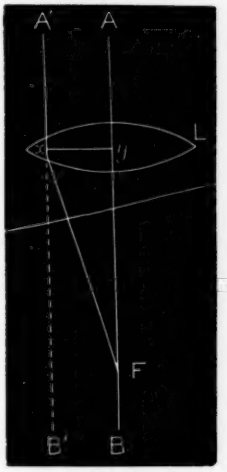


FIG. 5.

Let L (Fig. 5) be a lens with axis A B and its principal focus at F. A ray parallel to the axis, meeting the lens at any point, will be deviated and pass through the point F. Let A′ x be such a ray meeting the lens at x, undergoing there deviation and passing through F. The angle B′ x F is then the angle of deviation produced for a ray parallel to the axis, meeting the lens at the distance x y from its centre. For practical purposes, this angle B′ x F may be considered the angle of minimum deviation at the point x. Since A′ B′ and A B are parallel, angle x F y is equal to angle B′ x F.

We have then a right-angled triangle x F y in which y F is the focal distance of the lens, x y the distance which the lens is decentred, and angle x F y the angle of deviation of the

[1] "Diseases of the Eye," Am. edition, Philadelphia, 1889, p. 493.

[2] See also a paper by Schiötz and one by Prentice, these ARCHIVES, Nos. 2, 3, 1890.

ray. For x y putting d, and for y F putting f, and for angle x F y putting angle x, we have tan $x = \frac{d}{f}$ and $d = f \tan x$. For a given lens and angle of deviation the decentring necessary may thus be computed. Angle x is, however, the angle of deviation.

In a prism of crown glass having a refractive index 1.5, the angle of minimum deviation or dioptric angle is half the physical or refracting angle of the prism. Prisms are still marked for the most part with the number of degrees of their physical angle, notwithstanding the efforts to introduce Jackson's better plan of numbering prisms according to their dioptric angle or deviating power.[1] Maddox, throughout his table, gives the deviating angle of the prisms. The formula for finding the decentring necessary to produce the effect of a given prism, as prisms are now numbered, is $\tan \frac{1}{2} x = \frac{d}{f}$.

Prisms stronger than 4° before each eye cannot conveniently be used in spectacles. We need consider then for the various lenses only that decentring which will give a deviation equal to that produced by prisms of 1°, 2°, 3°, and 4°. If the formula be worked out for a lens of 1-inch focal distance, having a deviation equal to that of a 1° prism, the amount of decentring found may be taken as a unit, and for any other lens, the descentring necessary for producing the effect of a 1° prism, may be found by multiplying this unit by the focal distance of the lens in inches. Such units may also be found for prisms 2°, 3°, and 4°.

For the effect of a 1° prism, $x = 1°$, f = 1 inch = 25 *mm*, $d = f \tan \frac{1}{2} x$, $d = 25 \times .00872 = .218$ *mm*.

For the effect of a 2° prism, $x = 2°$, f = 25 *mm*, $d = 25 \times .0174 = .435$ *mm*.

For the effect of a 3° prism, $x = 3°$, f = 25 *mm*, $d = 25 \times .02618 = .654$ *mm*.

For the effect of a 4° prism, $x = 4°$, f = 25 *mm*, $d = 25 \times .0349 = .872$ *mm*.

[1] The numbering of prisms according to their metre-angles or dioptry-angles, lately advocated by so many writers, seems to me a cumbrous, inconvenient, and inaccurate system; and I have yet to see a valid argument in favor of its adoption.

A table may be made thus:

In a Lens of 1 *Inch Focal Distance.*

Effect of prism.	Obtained by decentring.
1°	0.22 *mm.*
2°	0.43 *mm.*
3°	0.65 *mm.*
4°	0.87 *mm.*

To find the decentring necessary to produce the effect of a given prism in any lens, *multiply* the unit for that prism by the focal distance of the lens in inches. Example: The effect of a 2° prism wished in the lens $\frac{1}{15}$. Decentring necessary 0.43 *mm* × 15 = 6.5 *mm.* Or since the amount of decentring for producing the effect of any prism is equal to .22 multiplied by the number of that prism, we may take simply—*lens* 1 *inch,* 1° *prism by decentring* 0.22 *mm. For the effect of any prism, multiply* 0.22 *mm by the number of that prism, and for any lens multiply this product by the focal distance of the lens.*

Such a table may be made also for lenses numbered after the metric system by taking the decentring required in a 1 D lens as the unit. These units may be obtained by multiplying each of the units in the preceding table by 40, the focal distance in inches of a lens of 1 D.

In a Lens of 1 *Dioptry.*

Effect of prism.	Obtained by decentring.
1°	8.7 *mm.*
2°	17.4 *mm.*
3°	26.2 *mm.*
4°	34.8 *mm.*

To find decentring necessary to produce effect of a given prism in any lens, *divide* the unit for that prism by the number of dioptries of the lens. Example: The effect of a 3° prism wished in a lens of 7 D. Decentring necessary, 26.2 *mm* ÷ 7 = 3.7 *mm.* Or take—*lens* 1 D, 1° *prism by decentring* 8.7 *mm. For the effect of any prism multiply* 8.7 *mm by the number of that prism, and for any lens divide this product by the number of dioptries of the lens.*

The decentring for cylinders and combinations containing cylinders may be computed by using the refractive power of the horizontal meridian of the lens. To produce the effect of prisms base in, convex lenses should be displaced inward, and concave lenses outward.

Applications of the Principle.

The actual geometric decentring of a lens for prismatic effect is a matter more complicated and expensive than the grinding of a combination of lens and prism. The application which may be made of the tables given above is in the displacement of the usual lenses by spreading the spectacle rims farther apart or by bringing them closer together than they stand when centred, which is a much simpler procedure than combining a prism with the lens. This displacement may conveniently go as high as 7 *mm* for each eye. The range of application will then be seen from the following table showing the prismatic equivalents of various lenses displaced 6 *mm*.

Lens.	Displaced.	Has effect of prism.
1 *D*	6 *mm*	.75°
2 *D*	" "	1.5°
3 *D*	" "	2.°
4 *D*	" "	2.75°
5 *D*	" "	3.5°

Displacing each lens 6 *mm* produces the effect of the prism in the right-hand column before each eye. In this manner the lack of muscle balance may be totally or partially corrected, according to the lens used and the prismatic effect desired. Since the amount of displacement can be easily changed at any time, this is a convenient method of trying prisms temporarily.

What are the objections to this procedure, and are they valid? Swanzy[1] objects to the decentring as being less accurate than combining a prism with the lens. Without a table or formula for finding the prismatic equivalent of decentring, it is a loose method and one not to be com-

[1] "Diseases of the Eye," p. 422.

mended, but, having these, it must needs be as accurate as the other.

Mauthner[1] objects that the prismatic effects obtainable are too small to be of use, but gives no figures to support his statement.

Berry, speaking of displacing two + 5 D lenses each 6 *mm* inward to ease convergence to the extent of 1 metre angle, the interocular distance being 60 *mm*, continues:[2] "A rather greater effect would be got by combining prisms of 2° with the spherical lenses, so that decentring has evidently only a limited practical application." But by his formula, when d = 6 *mm* and f = 3 inches or 200 *mm*, tan $\Delta = \frac{6}{200}$, and $\Delta = 1° 44'$, or nearly 2° of deviation for each glass, and the prisms which would produce this deviation are prisms of nearly 4°, the strongest prisms ordinarily prescribed. He has here apparently confused the deviating angle and the refracting angle, and 6 *mm*, or ¼ inch, is about the greatest displacement that would ever be required with a 5 D lens, and the practical application of decentring is not so limited by half as he presumes it to be.

The Centring of Lenses.—If the subject of the decentring of lenses is worth our attention, the subject of the proper centring of lenses is equally so. The objection to a decentred glass is that it has the effect of a prism before the eye, and alters the condition of the muscle balance.

Let us first consider the effect of prisms before eyes with a normal muscle-balance. A prism of 1° in many cases, a prism of 2° in every case, placed base in or out before one eye, will cause a perceptible deviation of the eyes on alternate covering. The muscle balance is disturbed. With a patient having muscular insufficiency, if the prism which corrects the insufficiency be held before one eye, the eyes will show no deviation on alternate covering.

Pince-nez glasses are almost never centred, bowed spectacles seldom, if the measurements be left to the optician. A hyperopic patient, for example, shows at the consultation a normal muscle-balance with the correcting lenses. He

[1] "Optische Fehler," p. 849.
[2] *L.c.*, p. 494.

gets the glasses from the optician, and when he returns the eyes show a deviation on alternate covering, when he fixes a point in the distance. The glasses then are not centred and the muscle-balance is affected. In many cases this may cause no asthenopia, but there is reason to believe that many of the cases of asthenopia persisting after glasses have been prescribed, are due to the prismatic effect of decentred lenses, which have relieved perhaps an accommodative asthenopia to cause a muscular one.

It is not a simple matter to say whether glasses are accurately centred to the patient's pupils. The alternate covering, with distant fixation for distance glasses and fixation at the reading distance for reading glasses, is a ready method of finding, not whether the glasses are centred for the pupils, which is of cosmetic interest only, but whether they are so placed that the muscle balance is preserved. If the muscle balance were normal, the eyes would show no deviation, on alternate covering, only when the glasses were centred for the visual axes. If there existed an insufficiency of the interni or externi, the eyes would show no deviation only when the glasses were so placed that their prismatic equivalents corrected the insufficiency.

What use may we make of this test in practice? If the eyes show no deviation on alternate covering, the glasses may be left as they are, unless they are so placed as to narrow inconveniently the binocular field of vision. If the eyes show a deviation on alternate covering, find that prism which will restore the balance and prevent the deviation. From the above formulæ compute the displacement necessary to produce the effect of the prism found. Dividing the effect between the two eyes, let the lenses be displaced outward or inward, not to exceed 7 *mm* each from the pupillary centres, until the whole prismatic effect is produced, or that part of it which one may be able to produce in the given case without excessive displacement.

If, for example, the prism found were one of 3° base in, and the lenses were + 4 D, as shown above, the displacement required would be 8.7 *mm* × 3 ÷ 4 = 6.5 *mm*, and the optical centres of the two glasses should be brought 6.5 *mm*

nearer each other, *i. e.*, each lens should be displaced 3.2 *mm* inward. The test for distance glasses should be made with distant fixation, for reading glasses with fixation at the reading distance, it being remembered that glasses centred to the pupils for the reading distance are from 2–3 *mm* nearer together than those centred for distant vision.

The purpose of this paper, the subject of which was kindly suggested to me by Professor Knapp, was to demonstrate mathematically these changes in the function of lenses whose axes do not coincide with the visual axes; further, to show in what circumstances these changes are to be avoided, and in what circumstances they may be utilized, and to give such formulæ and tables as may make it possible to employ them in our routine practice. Since, within the limits of their application, the tilting and the decentring of lenses are procedures simpler than those now commonly employed, it is to be hoped that these may come to have a more extended use.

A CASE OF NEURO-PARALYTIC KERATITIS, WITH MICROSCOPICAL EXAMINATION OF THE DISEASED EYE.

By G. E. De SCHWEINITZ, M.D.,

OPHTHALMIC SURGEON TO THE PHILADELPHIA AND CHILDREN'S HOSPITALS; OPHTHALMOLOGIST TO THE INFIRMARY FOR NERVOUS DISEASES.

SINCE the days when Herbert Mayo showed that section of the trigeminus within the cranium produced insensibility of the eye, and Magendie, in 1824, demonstrated that division of this nerve in rabbits resulted in anæsthesia of the globe, with inflammation and sloughing of the cornea, physiologists, ophthalmologists, and neurologists have undertaken a large amount of experimental research in the endeavor to definitely prove the cause of the corneal lesion. Even at the present day experimenters and clinicians are not in accord, and an examination of the statements in regard to the etiology of neuro-paralytic keratitis found in the standard text-books leaves the reader in doubt whether to accept that theory which ascribes the disease to a trophic change, or that which attributes it to the lessened power of resistance which the cornea, in its insensitive condition, presents to external injuries, or to believe, with Gowers ("Diseases of the Brain," p. 90), that "this neuro-paralytic ophthalmia, as it has been termed, probably depends on the irritation of the nerve by the lesion rather than on the anæsthesia, or on the mere loss of nerve influence."

The case which I am about to detail presents certain interesting features, both in regard to the probable situation of the lesion and the results of the microscopic examination.

William S., a German, aged fifty-eight, was free from disease until the year 1863 (perhaps 1866), when he was attacked, according to his own statement, with a bubo of the right side. He denied having had a chancre, but shortly after the appearance of the bubo his hair fell out. He continued to be in good health until three years later, when he contracted rheumatism, and at the same time iritis, which was double. These conditions were cured, and we have no further record of the disease until March, 1884, when he suffered from left hemiplegia, the arm and leg being involved in the paralysis, with a cure in twelve weeks. In 1885 he had a second apoplectiform seizure, unaccompanied by palsy, and followed by a rapid restoration to health. In January, 1888, he had left facial palsy, at which time the eye was said to have been inflamed, but there is no definite record as to the character of the inflammation, which evidently was not that which subsequently destroyed his sight. In midsummer of the same year he left the hospital without any evident inflammation of either eye, according to the statement of the trained nurses in attendance.

In January of the next year I made the following note: *Right eye*—Round pupil; light reflex preserved; large, oval, gray optic disc, with dish-like, shallow excavation; arteries as compared with veins smaller than normal; spots of pigment on the anterior capsule of the lens indicating the presence of a former iritis. *Left eye*—Pupil nearly occluded by the former iritis, and preventing any view of the fundus; no evidence of disease of the cornea.

About this time various examinations made by Drs. J. Hendrie Lloyd and Charles K. Mills developed the following facts in regard to this patient's general condition: The left side of the forehead was absolutely smooth, the left angle of the mouth drawn upward, probably due to a spastic condition. There was twitching of the eyelids and muscles of the left side of the face, inability to protrude the tongue, whistle, or dilate the left nostril. The left platysma was weakened, and the masseter and temporal muscles atrophied. The lower jaw could not be protruded to perform grinding movements, sensation was practically lost over the left side of the face, and degeneration reaction present in the muscles supplied by the seventh and fifth nerves. The left arm was paralyzed, with marked atrophy in the extensor and supinator muscles, together with advanced degeneration-reaction and wrist-drop upon this side. The muscles of the left thigh and leg were impaired in power, the extensors and abductors having

suffered more than their antagonists, but no atrophy was present, and there was ready response to both faradism and galvanism. Experiments with the tuning-fork seemed to prove the partial deafness which was present to be due to paralysis of the tensor tympani rather than to disease of the auditory nerve.

In March the type of keratitis which caused the destruction of his eye began to develop, and speedily the following conditions obtained, in spite of all treatment: Coarse episcleral injection, perforation of the lower half of the cornea with hernia of the iris, and a filling of the remains of the anterior chamber with blood, and absolute anæsthesia of the cornea and conjunctiva. Lessened intraocular tension.

To sum up, it will be seen that this patient suffered from an atrophic paralysis with degeneration in the left forearm; a paralysis not complete and not atrophic in the entire left leg; paralysis of the facial nerve and of the motor branches of the fifth nerve, involving some of the sensory fibres, producing anæsthesia of the left side of the face and of the left eyeball.

Dr. Mills, after an exhaustive study of this case, which has been reported in the *Times and Register* of December 7, 1889, and from which the facts in regard to the examinations other than those of the eye have been quoted, came to the conclusion that this man suffered from a lesion in the anterior horn of the left side, in the seventh cervical segment, and that it reached out to the adjoining segments, and also to the white matter of the crossed pyramidal tracts. The condition of the facial muscles was probably explainable by the presence of a lesion of the same character as that in the cord, destroying the cell groups of both the facial and trigeminal nerves.

The left eye, which caused the man great inconvenience and some pain, and the cornea of which had sloughed, was removed, placed in Mueller's fluid, and submitted to microscopic examination. The following lesions were found:

Below the centre of the cornea there is complete perforation of the cornea, the aperture being occupied by the stump of the prolapsed iris, which is granulating and crowded with numerous inflammatory and large, granular, pigmented cells. This central necrosis, which appears to have begun in the true corneal tissue and spread forward until the slough separated and perforation and prolapse followed, is sharply limited on either side, beyond which the cornea is quite free from inflammatory infiltration. As

the periphery of the cornea is reached we find the epithelial layer and overlying conjunctiva much swollen and separated by collections of deeply stained small cells, which have also invaded the corneal tissue, in places massed in pit-like depressions—evidently the earlier stages of abscesses. These lesions do not penetrate the entire thickness of the cornea, and beyond them, passing inward, comparatively healthy tissue remains.

Immediately in the neighborhood of, and surrounding the entrance to, Schlemm's canal, there is a collection of small round cells, apparently extending directly into the lumen of this sinus.

Following the iris from the position of its prolapse toward the ciliary body, this is seen to be swollen, inflamed, and infiltrated with inflammatory cells, a condition which repeats itself in the ciliary body. Of special interest are the vessels in these structures, particularly in the latter. They present one of the forms of obliterating arteritis. Taking as the type a small ciliary arteriole, it reveals in cross-section the following characteristics: An asymmetrically placed lumen contracted out of proportion to the size of the vessel; unusually prominent endothelial plates pushing their way into the central aperture, bounded externally by badly stained fibrous elements that have practically substituted the middle coat, which can still be seen in the periphery as a narrow circle of poorly developed muscular fibres, beyond which the indefinite tissue of the adventitia is apparent. The condition is analogous to that which has been described under the term mesarteritis.

The choroid, retina, and optic nerve are free from disease.

The ciliary nerves, where they pass through the sclerotic coat, were carefully sought out, but do not present, in the carmine sections, any evidence of inflammation or infiltration, and in those stained by Weigert's method any sign of degeneration. Their reaction to these reagents was in all particulars such as is seen in nerves of normal constitution.

The principal appearances as found microscopically are hence: A sharply-defined, central slough of the cornea, separated by nearly normal corneal tissue from a peripherally situated, secondary keratitis, having inflammatory connection with overlying diseased conjunctiva, but bounded below by reasonably healthy cornea; small-celled infiltration surrounding Schlemm's canal; inflamed iris and ciliary

body, through which tissues the arterioles present a form of arteritis of the type known as mesarteritis; normal choroid, retina, and optic nerve; and *unaffected ciliary nerves.*

The keratitis present in the eye under consideration, apart from its etiology, is interesting on account of its apparent mode of development. It bears a strong resemblance to the type described by Senftleben (*Virchow's Archiv*, Bd. 65, p. 69), and which he produced in animals in whom the trigeminus had been divided. Under these circumstances this investigator found that the primary affection of the cornea appeared as a necrosis originated by the repeated traumatisms which the eye encountered owing to its anæsthesia. This circumscribed necrosis of the cornea then acted as a seat of inflammatory irritation, and brought into existence a secondary keratitis proceeding from the periphery of the membrane.

The obliterating arteritis evident in the vessels of the ciliary body, in the study of which I have had the advantage of the assistance of Dr. Meigs, presents an inviting opportunity to construct a theory in regard to the etiology of neuro-paralytic keratitis. As, however, was originally pointed out byC. Friedlænder (*Centralblatt f. die med. Wissenschaft.*, 1876, p. 69) arteritis obliterans is found in specimens from clinical and experimental phthisis, in tumors, and in chronic inflammations, especially if accompanied by tuberculosis, an observation which Dr. Meigs has confirmed in his studies of the vessels in various diseased tissues. The existence, then, of this lesion in the present instance is to be explained as the result of a chronic inflammation, and in no sense as a cause of its existence.

The entire absence of disease of the ciliary nerves is a noteworthy fact, and demonstrates that although the nuclei of the fifth pair were affected, there was no degeneration or inflammation in the course of the peripheral distribution of this nerve.

It may be interesting briefly to refer to the various theories which, from time to time, have been advanced to explain the existence of neuro-paralytic keratitis. The earlier experimenters, Magendie, Claude Bernard, and von Graefe,

maintained that the destructive changes in the eye were largely due to the section of a trophic nerve. Snellen concluded that the disease was nothing more than a traumatic inflammation provoked by the presence of undetected injuries and foreign bodies. Schiff, noticing that section was followed by paralysis of the nerves of the vessels, together with widening of their calibre and later inflammation, relegated the cause to the nerve itself through a vaso-motor influence, but afterward modified this opinion by stating that a neuro-paralytic hyperæmia was conditioned by the development of an inflammation stirred up by outside influences. The experiments of Samuel, Buettner, Meissner, Eckhard and others gave rise to the tropho-traumatic theory, Meissner especially holding that the inner fibres of the nerve are more important in the trophic influence than any others. According to Buettner and Meissner the division of these fibres deprived the eye of its capacity to resist external influences. Among other theories is that one elaborated by Eberth, in which a mycotic influence was invoked to explain the disease. The pure traumatic theory, developed originally by Snellen, has found many advocates, notably Senftleben and v. Gudden.

The most recent elaborate work upon this subject is by E. v. Hippel (*Archiv f. Ophthalmologie*, Bd. xxxv., 2, p. 217), from whose paper I have abstracted the facts just quoted. This author cannot accept the presence of medially placed trophic fibres in the trigeminus, believes the pure traumatic theory to be untenable, denies the existence of an impaired power of resisting traumatisms on the part of the affected eye, which, however, is more exposed on account of the anæsthesia to desiccation than is the case with a normal one, rejects micro-organisms as etiological factors, and holds that the theory of increased evaporation is sufficient to explain the development of the inflammation, showing experimentally how a moist atmosphere can prevent the disease.

THE INTRODUCTION OF AN "ARTIFICIAL VITREOUS HUMOR" INTO THE SCLERAL CAVITY, IN SIX CASES.

By JOHN MORGAN, of Springfield, Mass.

THE following operations were performed in consequence of having seen a patient at the New York Ophthalmic and Aural Institute, upon whom Dr. Knapp had successfully performed Mules' operation. They were performed under ether anæsthesia. The opening was enlarged horizontally by removing two triangular pieces of the conjunctiva and sclerotic, thus changing a nearly circular opening to one represented by the following diagram,

in all but the first case. In the second case, the pieces cut out were about two lines wide at base, and five in length; in the remaining cases, three lines at base, and five long.

The hemorrhage continued about one hour and a half, and the "artificial vitreous humor" was not introduced until it had completely ceased. A solution of corrosive sublimate, 1 in 5,000, was used as an antiseptic in the first case; a hot saturated solution of boric acid in the second, third, and fourth; and hot water in the fifth and sixth cases. Some experienced no pain, and ate and slept regularly, while others had so little pain or discomfort as not to interfere

materially with their eating and sleeping. The wound was closed in all but the first case with six sutures of fine silk, one conjunctival on either side, and four through conjunctiva and sclerotic in the centre. Constitutional disturbance too slight to report.

CASE 1.—Conrad Bersiere, nine years old, *staphyloma of the cornea, and globe much enlarged.* On May 16, 1890, the anterior part of the eye was cut off about one line behind the cornea. After the sclerotic had been freed from its contents, and the bleeding had ceased, a glass sphere of medium size was inserted —which probably occupied less than two thirds the cavity which contained it—and the wound was closed horizontally with fine silk sutures. Hot-water dressings were continually applied for twenty-four hours, after which a compress and bandage, with now and then hot-water dressings while the swelling continued. On the following morning there was some redness and swelling of the upper lid and conjunctiva, which steadily increased until the sixth day, at which time the lids were greatly swollen, and the chemosed conjunctiva prevented their closure. No pain, no discomfort, and no discharge. From this time the swelling gradually subsided, and had nearly disappeared on the thirteenth day, when the dressings were found wet with dark blood, and the wound open at its centre, exposing the glass sphere. On the fifteenth day the wound could not be well closed with a suture, consequently it was enlarged. The sphere and the clot of blood in which it was embedded were removed ; a sphere of smaller size substituted, and the wound closed. On the eighteenth day this glass was visible through an opening of about three *mm* in its longer diameter, which was about one third the size of that on the fifteenth day ; the edges were then freshened, and brought together with an episcleral suture, which in a few days came out and left the aperture as large as before. It was then left to itself, and the patient began to wear an artificial eye. He was seen weekly until August 6th, when the closure was found complete, the sclerotic well contracted upon its artificial contents, providing a support for the artificial eye, which it carries and moves so well that the disfigurement is reduced to a minimum. This is true of all the cases.

CASE 2.—Joseph Thorpe, twenty-eight years old ; during the last week in November, 1889, a fragment of iron entered his eye,

and remained there until the day of the operation, June 10th, 1890, when the front part of the eye was cut off immediately behind the iris, the contents of the sclerotic were removed, and their substitute inserted. The two centre sutures were left unclosed for eighteen hours; hot-water dressings for twenty minutes were repeated every three hours, and compress and bandage constituted the treatment for the first twenty-four hours; after that, hot-water dressings for about five minutes, three times a day, and compress and bandage while the swelling continued. Reaction slight. All of the stitches were removed by the eleventh day, when there was an opening of about 3 *mm* at the centre, the edges of which were brought together with an episcleral suture, which proved a failure. Commenced to wear an artificial eye. As there was no apparent change in the size of the opening during the next three weeks, the edges were pared and brought together; this reduced the opening about two thirds; no more interference. Saw the patient weekly, and found wound closed on August 12th. Recovery in nine weeks.

Case 3.—Katie Donohue, sixteen years old; staphyloma of the cornea. Eye prepared for the reception of the artificial vitreous, as in the preceding case, July 24, 1890, excepting that as already stated the pieces cut out were broader at the base. Hot-water dressings were applied for half an hour at intervals of three hours, and compress and bandage for twenty-four hours; after that, compress and bandage with an occasional use of the hot-water dressings. No pain, no swelling, no discharge, only slight redness of the conjunctiva. Recovered in six days.

Case 4.—Tillie McGrath, twenty-two years old; staphyloma of the cornea, July 28, 1890; operation same as in case of Katie Donohue, followed by considerable redness and swelling of upper lid and conjunctiva and pain in same side of head. Hot-water dressings, compress, and bandage used as in the other cases. Recovered in eight days.

Case 5.—Frank Carmody, seven years old; wound of cornea and sclerotic, allowing escape of all the vitreous. About four hours after the injury, August 7, 1890, the eye was prepared for the artificial vitreous, as in the two preceding cases. The eye was dressed with compress and bandage, changed daily for three days, then every other day for four days. No pain, no discharge; swelling of the lids and conjunctiva very slight. August 14th the wound was closed, and began to wear artificial eye.

Case 6.—Wm. D. Pease, forty years old; eye contained foreign body. Operation September 7, 1890, which did not differ from the three preceding cases. Reaction manifested by redness and swelling of upper lid, and conjunctiva, and pain in same side of head. Hot-water dressings, compress, and bandage were used. Recovered in thirteen days.

The patients have all been kept under close observation since the operations, and several of them, including the first, have been seen since Dec. 4th. Some of them have worn their artificial eyes from one to two weeks without removal, and have experienced no discomfort. The conditions appear to be permanent, and the results are satisfactory.

A CASE WHERE REMOVAL OF AN EYE WAS FOLLOWED BY HYSTEROID CONVULSIONS.

By JOHN DUNN, M.D., Richmond, Va.

The patient, a mulatto girl, aged nineteen, came to the clinic of the Richmond Eye, Ear, and Throat Infirmary, September 5, 1890, for treatment of her right eye, the condition of which was as follows: Lids swollen and œdematous. Excessive exophthalmos. Conjunctiva red, swollen, and furnishing a large amount of purulent matter. The cornea had ruptured in the upper one-third of its circumference, and through the rupture appeared a corresponding portion of the iris. The eye was so painful to the touch, and the neuralgic pains through the right side of the head so great that panophthalmitis seemed almost certainly present. The lower two-thirds of the cornea were still transparent in most of their extent. Anterior chamber was obliterated; vision totally gone. The history of the case and the appearance of the eye, though both mother and the girl herself protested in the strongest terms that she had no vaginal discharge, nor had it been possible for her to get the eye inoculated, pointed to gonorrhœal ophthalmia, followed by rupture of the cornea, prolapse of the iris, cellulitis, and most probably panophthalmitis as the causes of the present condition of the eye. The first symptoms of the trouble had appeared about four weeks previously, and the eye had grown steadily worse. The left eye, except a slight congestion of the conjunctiva, was healthy.

As there was no hope of saving the eye, the question arose as to the best method of alleviating the pain and of subduing the inflammation. Enucleation was certainly the best method, but was it safe in the presence of a gonorrhœal process, even though the acute period of the inflammation was over?

Cold antiseptic applications were ordered to be kept constantly to the eye. These lessened in some measure the pain about the eye. On September 8th the patient complained that the vision of the left eye was failing. Examination showed its pupil half dilated, and responding very sluggishly to the light. The conjunctiva showed an increased redness. Patient complained of some pain in this eye. The change in the condition of the right eye was not marked, except that the cornea had become shrivelled and entirely opaque and resembled in appearance a piece of horn. The possibility of a beginning sympathetic involvement of the second eye, even though the ophthalmoscope as yet revealed nothing, determined me to run the risk of a meningeal inflammation and to remove the right eye. The secretion from the conjunctival surfaces was washed off with bichloride solution, and after the removal of the eyeball, the orbital cavity was washed well with the same solution. I then took some iodoform on the end of my forefinger and rubbed it well into the diseased conjunctiva, especially the thickened part on the lids and in the culs-de-sac, using absorbent cotton soaked in bichloride ($\frac{1}{1000}$) as the outer dressing.

Examination of the eye after removal: Passing a probe under the prolapsed iris, it went directly into the vitreous, which I expected to find in a state of advanced inflammation. With a pair of scissors I opened the ball from the prolapse to the optic nerve and thence across to the opposite side. There were no visible disturbances of retina, choroid, or vitreous.

I was unable to see the patient until the following afternoon about two o'clock, when I learned from the mother that, about eight hours after the operation, the patient was taken with vomiting and had had numerous convulsions of the severest kind; that she had called in several of the neighbors to help hold her daughter in bed, and so violent had been her struggles that the bed had broken down under them. I found the patient on a pallet on the floor. She said she had no pain in any part of her body, save in her arm, where a hypodermic of morphine and atropine had been given her prior to the operation. She had no fever. Her skin was moist and warm. Her pulse was 85 and regular. Respiration normal. Pupil of left eye was still somewhat dilated, but responded well to light. There was no discharge from the lids of right eye. And I will remark here that I did not again see any purulent discharge from this eye, to

which were kept constantly chlorine applications. I was especially surprised at this, considering the discharge that was constantly present before the operation. And its cessation must be attributed to the rubbing in of the iodoform. The patient had no headache; answered all questions perfectly rationally, but showed a great desire to sleep, and would fall asleep the instant she was left alone. As patient had not passed her urine for twenty-four hours, I ordered hot applications to the abdomen over the bladder. At 7 P.M. I had to see the patient again, as she was thought to be dying. She had passed her urine soon after the hot cloths had been applied to the abdomen, and had made an attempt to stool. The exertion had probably been too great, for as soon as she was again placed in bed she began to gape, and when I saw her she was gaping about every thirty seconds. The patient would open her mouth to its fullest extent, draw in her breath, and then end the gape with a sigh resembling that of a person very tired. Between the gapes the patient lay perfectly listless. A cup of very strong coffee was ordered to be made and the patient made to drink it. The gaping ceased in a few minutes, and did not return until about 10 o'clock that night, when an attempt was made to change the bed linen which had become soiled. The patient had to exert herself slightly, when the gaping returned. The mother repeated the coffee, and the patient passed a good night. The following afternoon, 11th of September, patient was resting quietly enough, though she complained of some pain beneath the left breast, and was not able to restrain the desire to gape from time to time. The same night patient had, off and on, for two or three hours, convulsions, and with them, opisthotonos, so severe that at times she was resting only on the balls of her heels and the back of her head, and her back so bent that the mother feared it would break. At times the patient would shake her head from side to side, so rapidly and with so much force, that it looked as if she were "trying to shake it off." The convulsions were preceded by attacks of gaping. The afternoon of the 12th the patient was comfortable enough. The only pain of which she had complained during the day was one which would start from the region of her right ovary and would shoot down her thighs. This region was tender on pressure. No fever. Pulse irritable. Right conjunctiva rapidly regaining its normal condition. Irritation symptoms in O.S. have disappeared. The patient says that she remembers the gaping that preceded the convulsions, but of the convulsions

themselves and of the opisthotonos she remembers nothing. She remembers shaking her head from side to side, that it was extremely painful, but she could not stop it. Bromidia was ordered, and word was left with the mother to let me know if the attacks returned. I did not see the patient again for ten days, when she came to the clinic. There had been no further return of the hysterical symptoms. The stump had healed.

In looking for a probable origin of the hysterical attacks, I can find none other than the emotional effect upon the higher nervous centres, produced by the idea of the change from the position of belle of her tendom to that of a horrid one-eyed wench. I thought it best not to tell the girl I was going to remove her eye, when I informed her that it was necessary to give her chloroform, for she was run down and much emaciated from the pain she had suffered for four weeks. I told the mother what I was going to do. Thus the girl did not know that her eye had been removed until several hours after the operation, and then, while still weak and sick from the chloroform and still under the influence of morphine, had inferred, from her mother's refusals to answer her questions about her eye, that it had been taken out. Within three weeks after the operation the girl fattened at least fifteen or twenty pounds, so rapidly did her health and strength return when the cause of their deterioration was removed, and it is to this, I think, that must be attributed the fact that the hysterical symptoms disappeared in so short a time.

P.S.—Since the above notes were taken I have learned from the physician who treated the girl before she came to the clinic, that she had a vaginal discharge, most probably gonorrhœal, at the time that her eye trouble began.

A CASE OF INTRACRANIAL NEOPLASM WITH LOCALIZING EYE SYMPTOMS: POSITION OF TUMOR VERIFIED AT AUTOPSY.

By CHARLES A. OLIVER, M.D., of Philadelphia.

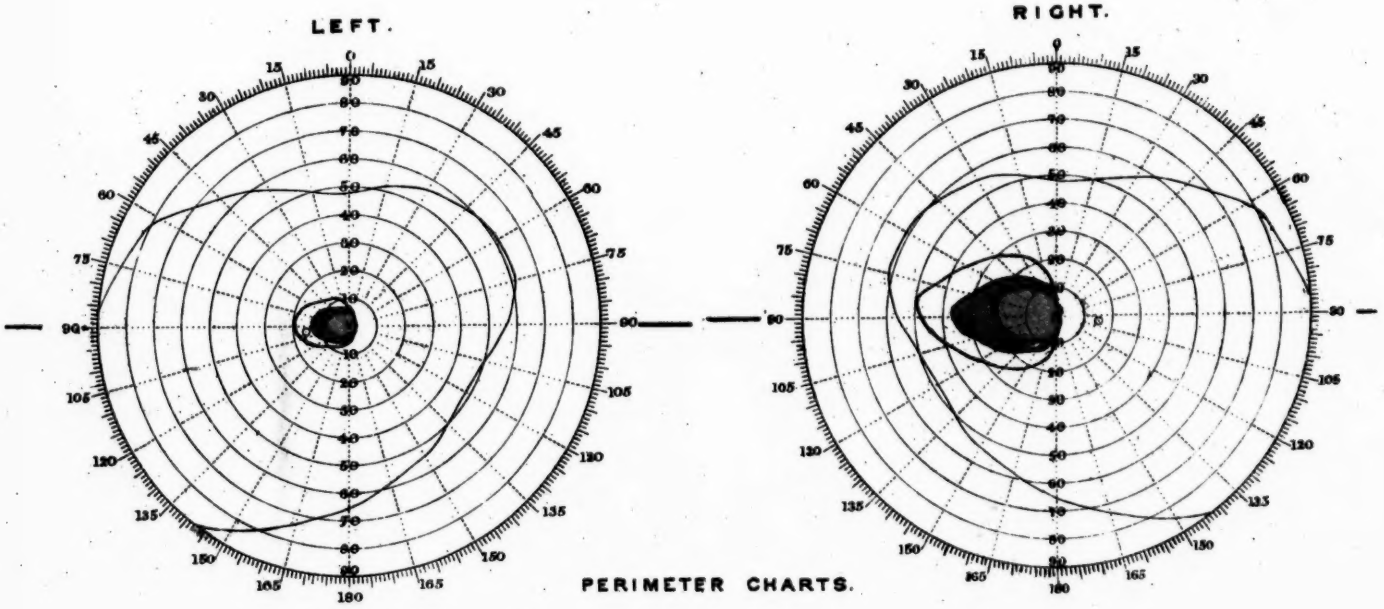
(*With a chromo-lithographic perimeter chart.*)

On the 28th of February, 1890, Dr. Francis X. Dercum and the writer met Dr. A. S. Gerhard, the attending physician in consultation in the case of H. N., æt. 39 years, a bridge and wharf builder, who without any history of traumatism, abuse of tobacco or stimuli, or venereal contagion, stated that for two years previously he had suffered with vertigo, headache, and attacks of momentary blindness. In April of 1889 his right foot felt stiff, numb and weak, whilst he repeatedly stumped the toes of his right foot against objects; this persisted until August of the same year. At this time a series of curious motor symptoms of a peculiar nature developed themselves. The right arm was adducted to the trunk, the forearm became flexed upon the arm, the hand was thrown against the forearm, whilst the fingers remained extended, especially the index, the middle, and the ring finger; the seizures holding their maximum for the fraction of a minute and then gradually disappearing.

These attacks became increasingly frequent, until when the patient was first seen they occurred every few minutes. Dr. Dercum, who saw several of these seizures, describes them as distinctly athetosic in character. During the attacks, the right leg would become extended.

When first seen by Dr. Dercum on February 3, 1890, the

[1] Dr. Francis X. Dercum has presented a short account of this case from a neurological standpoint at the last meeting of the American Neurological Association: the present report which was read before the American Ophthalmological Society, 16th July, 1890, is given from an ophthalmic view only.



PERIMETER CHARTS.

patient appeared to be a well-built, healthy man with seemingly large, broad muscles. Careful examination, however, showed that the right leg dragged as though spastic. The right grip was weak, and the right patellar tendon reflex was much exaggerated. Right ankle clonus was produced at every examination, whilst knee clonus could be obtained upon the same side at times. No distinct evidences of any mental impairment could be determined. Temperature sense, pressure sense, and muscular sense were all markedly diminished on the right side. Right lateral hemianopsia without any other gross ocular lesion were found.

On the 26th of February, the patient complained of headache associated with marked diminution of sight in the remaining half fields of vision. At this time he became irritable and nervous. Two days later, when first seen by the writer, the following ophthalmic grouping of symptoms were noted:

1. *Acuteness of Direct Vision for Form.* Reduced to $\frac{1}{8}$th. of normal ($V=\frac{5}{40}$) equally on each side, even when properly corrected by minus lenses, thus showing marked disturbance either of some portion of the ocular apparatus which is distributed to both ocular retinæ, or of the ocular tunics themselves.

2. *Direct Vision for Color.* Slightly lowered, especially on the left side; the error manifesting itself for both green and red. This result also shows disturbance either in some part of the ocular apparatus which is distributed to both ocular retinæ or in the ocular tunics themselves, the greater disturbance being on the left side.

3. *Power and Range of Accommodation.* Normal for age and amount and character of error of refraction on each side.

4. *Position of Areas of Visual Fields.* Right lateral hemianopsia, much more marked on the left side.[1]

These conditions of the visual field are extremely important, as they doubly point both by the relative smallness of the left visual fields and the left-sided position of both the remaining areas, towards a disturbance of visual apparatus in the left cerebrum.

5. *Characteristics of Visual Fields.* Feebly negative scotomata marked throughout the remaining green color areas, more pronounced in that of the left eye: this symptom is of immense col-

[1] The accompanying charts show this very well, the remaining fields of the right eye occupying about one twelfth of their normal areas, whilst those of the left eye are six times smaller.

lateral advantage, as it distinctly shows that the greater amount of irritation is on the left side.

6. *Size of Pupils.* Pupils four millimetres each in horizontal meridian, upon monocular exposure to equal degrees of light stimulus.

7. *Action of Irides.* Wernicke's hemiopic pupillary reaction sign (more properly—hemianopsic pupillary inaction sign[1]) plainly manifest upon both sides; the left iris not so prompt to light-stimulus as its fellow. These two peculiarities of iris behavior—the hemianopsic want of response and the inequality in amount of action taken in conjunction with the fourth observation—serve to show distinctly some disturbance in the sensory-motor arc of the ocular apparatus at the base of the brain in the left optic tract anterior to the corpora quadrigemina and posterior to the optic commissure.

8. *Extraocular Muscles.* With the exception of a slight insufficiency of both interni, extraocular muscle motion intact in every direction.

9. *Fundus Changes.* *a.* Characteristic peculiarities associated with high degrees of myopia equally pronounced in both eyes.

b. Both retinal arteries and veins of the right side, enlarged, tortuous, and apparently carrying dark-colored blood,—a condition which is probably explained by either lymph or blood extravasations into the tissues of the optic nerve or its envelopes.

c. A broad superficial splotch-like hemorrhage, extending over the lower outer quadrant of the right disc, and not seemingly connected with any retinal or choroidal stem. This most curious symptom may be partially explained upon the supposition that the mechanical impediment to the passage of fluid into the intravaginal sheaths of the optic nerve by an intracranial neoplastic formation is greater on the affected side of the brain than on the opposite.[2]

It will be seen that the conditions contained in 2d, 4th, 5th, 7th, and 9th observations, taken together, distinctly point toward a gross left-sided intracranial lesion, situated in

[1] Seguin uses the term, "hemiopic pupillary inaction sign." As the term hemiopic has been discontinued, the modified term, as above given, is most probably the best.

[2] *Vide* article on Ophthalmoscopy in vol. iv. of Keating's "Cyclopedia of Diseases of Children." It must be understood, however, that this rule can only be true when the optic-nerve extravasation has been secondary, as it were, to the great increase of cerebral bulk.

such a position as to cause the greatest pressure upon the left optic tract between the corpora quadrigemina and the optic chiasm, a few of the contiguous crossing fibres of the right side being also irritated and somewhat pressed upon; whilst the right-sided hemianæsthesia and the general symptoms upon that side distinctly place the greatest force of the lesion in the region of the left pulvinar.

During the following three weeks the patient complained more and more of diffuse headaches, until at last he became somnolent and stuporous, dying on the morning of 21st of March.

Post-mortem examination showed a normal calvarium with no special peculiarity of the membranes, except that they were slightly injected and rather dry. The left hemisphere was distinctly bulging, whilst the superficial substance of the brain appeared pale and somewhat anæmic. Upon horizontal section, the left lateral ventricle was found to be shallower than the right, though both were otherwise normal. The left optic thalamus was distinctly indurated and resistant to the touch; its substance being decidedly distended and swollen. Perpendicular section of the hardened mass revealed a neoplasm invading the external portion of the left optic thalamus, as well as the corpus striatum, almost as far as its anterior third. The growth itself was pinkish yellow in color, and was more resistant than the surrounding tissue. The capsule was not invaded. The left optic tract as far as the chiasm was markedly flattened and pressed upon. The right brain was seemingly untouched and unharmed.

Microscopic section of the tumor revealed a glioma with commencing sarcomatous degeneration. Study of the optic tracts, chiasm, and optic nerves gave negative results.

THE LIGHT-STREAK AS SEEN UPON THE CENTRE OF THE RETINAL VESSELS, DUE TO REFLECTION, REFRACTION, OR TO BOTH?

By ACHILLES E. DAVIS, A.M., M.D.,

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(*With Drawing.*)

THE light-streak seen upon the centre of the retinal vessels, and its causes, has been a fruitful subject for discussion since Loring's theory, in 1870, in contradiction to the accepted theory of its cause up to that time.

In 1853, Van Trigt[1] first advanced the theory of the production of the light-streak, as seen upon the retinal vessels, by the *reflection* from the anterior surface of the vessel-wall back into the observer's eye, of those rays of light from the ophthalmoscopic mirror, which fell directly on the summit of the retinal vessels. In this theory, shortly afterwards, he was sustained by Jaeger,[2] who accepted it *in toto* at the time, but in after years (1869, in his last book[3]), though adhering to his former view of the subject, ascribed the phenomenon to a reflection of light from the anterior surface of the *blood-column*, rather than to a reflection from the anterior surface of the *vessel-wall*, as he formerly maintained. Mauthner, in his work, 1867, also accepted the theory of Van Trigt, claiming that the light-streak was due to reflection of light from the anterior surface of the vessel-wall. In fact, the theory of *reflection* was accepted by the profes-

[1] Dissertat. ophthal. inauguralis De speculo oculi.
[2] "Ergebnisse d. Untersuchung d. mensch. Aug. m. d. Augenspiegel," 1854.
[3] "Ophthalmo. Hand. Atlas," 1869.

sion in general, and was not questioned until 1870, seventeen years after its first advancement by Van Trigt; when Loring, in his celebrated article[1] on this subject, took an exactly opposite view of the question, and advanced the theory of *refraction* of light as the chief cause in the production of the light-streak.

He attributed the presence of the light-streak, as seen upon the centre of the retinal vessels, not to the *reflection* of light from the anterior surface of the vessel-wall, or from the anterior surface of the blood-column, but to the *refraction* of those rays of light falling on the summit of the vessel, penetrating it and the blood-column, these being reflected slightly by the posterior wall of the vessel, but chiefly by the underlying tissues, back through the vessel and blood-column into the eye of the observer, the refractive action of the blood-column condensing the light as it passes through it both ways, just as a bi-convex lens, thus causing the light-streak. (See drawing on next page.)

In proof of this view, he not only cited many facts, but performed a most unique and simple experiment, which I will give briefly for the benefit of those who have not read of it, and as I make a similar experiment, differing in one essential point only, that is, to use the actual blood-column where he used a solution of carmine and water.

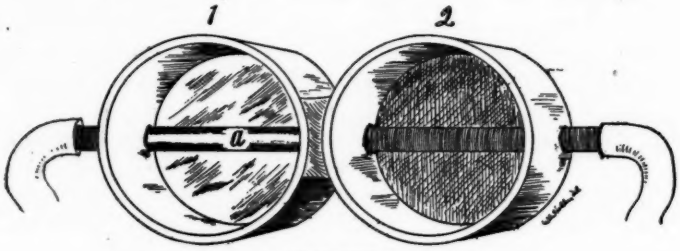
In his experiment he took two cylindric boxes, about three inches long and one inch in diameter each, fastened them together longitudinally; at the bottom of one, which we shall call 1, he placed a reflecting surface, an ordinary ophthalmoscopic mirror, and at the bottom of the other, which we shall designate 2, he placed a non-reflecting surface. Just in front of the reflecting surface in the one case and the non-reflecting surface in the other, in a transverse direction, he passed a very thin glass tube about a line in diameter, containing a solution of carmine and water.

In a rough way he let this represent the human eye, the mirror representing the retina, and the tube with carmine solution a retinal vessel.

Casting the light down these cylinders with an ophthal-

[1] *Trans. Amer. Ophthal. Soc.*

moscope, just as in the examination of an eye, he obtained in the cylinder with the reflecting surface—the mirror at the bottom—a light-streak on the tube containing the carmine solution, just like that obtained on the retinal vessels of the eye; whereas when he cast the light down the cylinder with the non-reflecting surface at bottom, he obtained a diffuse red light, which extended across the entire diameter of the tube containing the carmine solution, and not a light-streak, as in the other cylinder; thus showing that where the reflecting surface is wanting behind the tube in the one case, and behind the retinal vessel in the other, as in detachment of retina, there also is the light-streak wanting; and, *vice versa*, where there is a reflecting surface



1. Cylinder with reflecting surface at bottom.
2. Cylinder with non-reflecting surface at bottom.
a. Hole in ophthalmoscopic mirror.

This instrument was kindly made for me by Messrs. Georgen & Hann, opticians, 54 E. 23d Street.

behind the tube or retinal vessel to reflect the light back through them a second time, there the light-streak is present. Furthermore, if the light-streak depended *solely* on the reflection of light from the anterior surface of the tube or vessel, and not on the refraction of light passing through it and reflected from the underlying tissues, then the presence of a reflecting or non-reflecting surface *behind* the tube or vessel would be immaterial, according to Van Trigt's theory, in its production.

But we do not find this to be so; in fact, we find that we obtain a light-streak only in that instance where we have a reflecting surface beyond the tube or vessel, thus showing that the light-streak depends upon something more than

simple reflection from the anterior surface of the tube, for if it did not, then we should get it in the cylinder with a non-reflecting surface at the bottom, as they are seen, so far as they themselves are concerned, under precisely the same conditions.

The analogy of the instrument used by Loring to the human eye, so far as physics are concerned, is exact, and, consequently, what is true of the one is also true of the other.

But as clearly and completely as his experiment seemed to prove the cause of the presence of the light-streak on the retinal vessels, it still left the solution of the question in doubt, and by many writers the truth of his theory was stoutly denied. Notably among those who opposed the theory of *refraction* was Schneller,[1] who maintained the theory of *reflection* as advanced by Van Trigt in 1853, and brought forth many explanations to sustain his objections, but all of which were untenable as afterwards shown by Loring.

H. Knapp[2] has this to say about Schneller's article against Loring's theory: "Schneller's experiments and statements are, in part at least, as far as can be judged without repeating them, correctly refuted by Loring."

Prof. F. C. Donders was another to oppose Loring's theory and to sustain Van Trigt's, and, as he says, for the following reasons (which I give in full, as I expect to refute them):

"1. The blood-cylinder in the vessels of warm-blooded animals (Becker examined frogs only) is non-transparent; consider that light has to traverse this cylinder twice in order to form, according to Loring, a light-streak by refraction.

"2. The light, after passing twice through the blood-column and undergoing the numerous reflections and refractions on both sides of the blood corpuscles, must be totally diffuse and unfit to produce an image.

"3. Such an image would be situated in front of the wall of the vessel, not behind it.

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[1] Graefe's *Arch. of Ophthal.*, xviii., 1, pp. 113–126.
[2] Knapp's ARCH. OF OPH. AND OTOL., vol. iv., No. 1, p. 147.

"4. The light-streak remains unchanged when an artery runs directly over a wide, darker vein which cannot send back the same kind of light through the artery. Furthermore, the tapetum of animals and morbid changes, by which the fundus oculi becomes lighter, have no material influence on the presence of the light-streak."

To objection No. 1 (and this is the one he lays most stress upon), "that the blood-cylinder is non-transparent in *warm-blooded* animals," I can give positive proof as to its invalidity by the following very simple experiment. To perform the experiment I used an instrument similar to that used by Loring in his experiment which I have described above, with this addition to it, to wit: I attached to either end of the very thin glass tube that extends transversely across the two cylindric boxes two small rubber tubes, letting one of these tubes extend into a basin of water, while the other tube had a cone-shaped glass tube fastened in its end—for what purpose I will mention a little later. To obtain a column of blood from a *warm-blooded* animal I made a vivisection on a cat, first etherizing it, then dissecting down upon one of the carotid arteries, and making a small opening into it, introduced the cone-shaped glass tube above mentioned into this opening, which conducted the blood to the small rubber tube which was attached to it, and this in turn conducted it to the small glass tube (1″ in diameter) which ran through the instrument, and thence through the other rubber tube into the basin of water. The reason for conducting the blood to a basin of water was to keep the flow of blood for some minutes. In other words, I made a simple transfusion of blood from the cat to the basin of water in the same manner exactly as we transfuse blood from one animal to another, or from an animal to man. With the proper assistance this is easily done.

Now, with every thing in readiness, the column of blood flowing through the thin glass tube just in front of the mirror in cylinder 1, in the one case, and the non-reflecting surface in the other cylinder, 2, I cast the light down the cylinders from an ophthalmoscope just as in the examination of an eye, and obtained exactly the same phenomena as

Loring when experimenting with a solution of carmine and water—that is, in the cylinder with a mirror at the bottom, a light-streak along the centre of the tube containing the blood-column, this light-streak being limited, both above and below, by a darker red border, but disappearing altogether from the tube when the tube runs in front of the hole in the mirror (this last fact I mention because I will have occasion again to call attention to it). Secondly, on looking down cylinder 2, we do not get any light-streak at all on tube also containing the blood-column as in cylinder 1, but a diffuse red light extending across the entire diameter of the tube.

But why should we obtain two such opposite results in looking down the cylinders, *e.g.*, a light-streak on the tube in one, a diffuse red light on the tube in the other? Evidently not because of any difference in the tube in the cylinders, for it was one and the same tube; certainly not to any difference in the blood, for it was one and the same blood; it must be, therefore, due to some condition external to the tube, and this condition, in this instance, is a difference in the surfaces beyond, the one a reflecting, the other a non-reflecting one, thus showing that the light-streak depends upon the character of the surface beyond the tube. However, according to Van Trigt's and Jaeger's theory of the production of the light-streak, that is, to a simple reflection of light from the anterior surface of the vessel wall or its contents, the surfaces beyond the vessel or tube would have no influence in the production of the light-streak one way or the other. But we find that it does, and in this very instance, for "if," as Loring says, "the light-streak seen in 1 was simply due to a reflection from the wall of the tube, or its contents, then we ought to get it also in 2, as the tube is one and the same as that in 1, and is seen, so far as it is itself concerned, under precisely the same conditions."

Furthermore, that the light-streak does depend upon a reflecting surface beyond the tube in order that light may be reflected back through the tube and acted upon by the refractive power of its contents, and not to a simple reflec-

tion of light from the anterior surface of the tube or its contents, or even the posterior wall of the tube, is shown from the fact that just where the glass tube passes in front of the hole in the mirror—that is, when the reflecting surface, beyond the tube is wanting—there likewise is the light-streak wanting (see drawing, *a*, No. 1). "This is due," as Loring says, in his experiment with the carmine solution with a similar result, "evidently to the fact that just where the hole is, the light after having passed through the tube does not strike upon the mirror, but passes through to the bottom of the box beyond, which being of a non-reflecting nature does not permit sufficient light to come back to the observer's eye to produce the light-streak."

Now, therefore, having gotten *in every detail* the same phenomena with the *actual warm blood-column* that Loring did with the carmine solution, proves: *first, that the blood-column in warm-blooded animals is transparent; secondly, that it does transmit light, at the same time exerting a refractive action upon it; thirdly, that it does produce well-defined images, e.g.*, the light-streak on the tube in cylinder 1, and on the retinal vessels in the eye.

And the fact that it does produce a well-defined image nullifies Donders' second objection to Loring's theory, to wit: "the light, after passing twice through the blood-column and undergoing the numerous reflections and refractions on both sides of the blood corpuscles, must be totally diffuse and unfit to produce an image."

To further establish the fact that the light-streak is *due* to the refractive action on light of the blood-column, and to transmitted light; and at the same time that the blood-column in warm-blooded animals is transparent and capable of producing well defined images by its refractive power on light, I performed the following experiment. A vivisection was made upon a cat, as before, cutting down on one of the carotid arteries in the neck, transfusing the blood from this through the same tube that I used in the previous experiment. This time I placed the very fine glass tube, with the blood flowing through it, under the microscope, using a very weak objective, also a weak eye-piece. Here I ob-

tained a similar result to that obtained by Becker,[1] in his experiments with the mesentery of frogs under the microscope, to wit: a light-streak on the summit of the tube, similar to that upon the summit of the retinal vessels of the eye. Therefore it is evident, and according to a law of physics, which can be disputed by none, that the blood-column in *warm-blooded* animals, as well as in cold-blooded (Becker on frogs), is transparent, does exert a refractive action upon light, and is capable of producing well-defined images. That the light-streak in my last experiment was produced by transmitted light, refracted by the blood-column, and not by reflected light from the anterior surface of the blood-column, cannot but be evident to the least observing. Consequently, this fact being admitted, it not only makes the theory of refraction as the cause of the light-streak, as first advanced by Loring, in 1870, wholly tenable, but establishes it as an indisputable fact, sustained by optical and physical laws.

The other two objections—Nos. 3 and 4—of Donders, to Loring's explanation of the cause of the light-streak, can easily be disposed of.

No. 3. "Such an image" (speaking of the light-streak) "would be situated in front of the wall of the vessel, not behind it." By which objection he upsets his own theory, as advanced by Van Trigt; for if, as they claim, the light-streak be due to a reflection of light from the anterior surface of the blood-column, then the image would, being reflected from the anterior surface of the blood-column, necessarily be behind, and not in front of the vessel-wall. Whereas, according to the theory of refraction, it would be in front of the vessel-wall; and such is really the case, as the blood-column acts as a bi-convex cylinder, as we have shown above, and the image it produces must, according to known optical laws, be in front, not within or behind it. So much for No. 3.

Objection No. 4. "The light-streak remains unchanged when an artery runs directly over a wide, darker vein, which cannot send back the same kind of light through the artery,

[1] Graefe's *Arch. of Ophthal.*, xviii., p. 280.

etc." This objection, I think, was answered by Loring himself, when he gave in proof the example of the light-streak disappearing from the retinal vessels in detachment of the retina, ascribing the cause for its disappearance here to the diffusion of light by the fluid beneath the retina, for the light-streak remains unchanged on the vessels, up to the very edge of the detachment, but disappears immediately, as soon as the vessel runs upon the detached portion. Therefore, if the light-streak was due to the reflection of light from the anterior surface of the blood column, then it ought not to disappear from the vessel upon the detached portion, for the underlying fluid would have nothing to do with it in that case.

To add to this already convincing evidence in favor of refraction are two cases in its support, given by Noyes[1] in his late text-book on "Diseases of the Eye." In one of the cases (I give in Noyes' own words) "there was an effusion of blood beneath the choroid, which made a dark patch. This was crossed by a vein, on which no light-streak was present, while it traversed this dark surface, but when situated upon the normal choroid, the usual streak was present. As the blood-patch became absorbed, and a white scleral surface came to view, which was caused by rupture of the choroid, not only did the vessel recover its usual light-streak, but this became much more decided than upon the adjacent portions of the vessel. A second case bearing upon this point was one of extreme colloid deposit upon the choroid, having all the brilliancy of the most marked patches of fatty degeneration, as found in albuminuric retinitis. This glittering surface was about two discs long and one disc wide, and was behind one of the transverse retinal arteries. As the artery crossed the spot, the whole vessel was a bright ribbon of light, the central streak being intensified and widened, so as to equal the diameter of the vessel. On either side of this spot the artery had the usual appearance."

With such confirmatory evidence as this, and coming from such authority, I think we can safely let the question rest; though it is in opposition to such eminent authority as Van Trigt, Jaeger, Donders.

[1] Noyes' "Text-Book on Diseases of the Eye," p. 50.

A CYSTIC TUMOR OF THE LACHRYMAL GLAND.

By MATTHIAS L. FOSTER, M.D.,

ASSISTANT SURGEON MANHATTAN EYE AND EAR HOSPITAL, LECTURER AT THE NEW YORK POLY-CLINIC, OPHTHALMOLOGIST TO THE LADIES' DEBORAH NURSERY AND CHILD'S PROTECTORY AND TO THE UNITED HEBREW CHARITIES, LECTURER ON DISEASES OF THE EYE AND EAR AT THE H. W. BISHOP TRAINING SCHOOL FOR NURSES.

Read before the Section in Ophthalmology, Academy of Medicine, New York City, Oct. 20, 1890.

A lady, aged forty-five years, came to me in February, 1890, to seek relief from a tumor which had displaced her eye and was causing considerable pain. An operation had been performed six years before, by a local physician, who evacuated a quantity of watery fluid through an incision in the upper lid. The tumor immediately recurred and slowly increased in size, and for two weeks previous to her consultation with me the pain had been excessive.

On examination I found the upper portion of the right orbit occupied by a soft, fluctuating, apparently lobulated tumor, measuring two by one and a half inches. The eye was flattened from above downward, and pressed forward and downward upon the cheek so far that the lids did not quite close over it. The cornea was hazy, the pupil contracted, vision = fingers at four feet. An ophthalmoscopic examination was attempted, but was found to be very difficult and had to be abandoned on account of the nervous condition of the patient. On eversion of the lids the bluish appearance described as characteristic of dacryops was not to be seen. The patient claimed that tears came from the eye when she cried.

The same afternoon the patient was placed under the influence of ether. After the eyelids and adjacent skin had been thoroughly cleansed with soap and water and a solution of corrosive sublimate, an incision two inches long was made over the middle

of the tumor, about a quarter of an inch below the supraorbital ridge, parallel to the cicatrix which resulted from the former operation. An attempt to dissect out the cyst in its entirety had to be abandoned as impracticable, because a large part of the wall of the main cyst was firmly adherent to the periosteum covering the orbital plate of the frontal bone. This main cyst extended backward an inch and a half from the supraorbital ridge, and contained at least ℥ ss. of clear, straw-colored fluid. It may give a better idea of the size of this cavity if I state that I passed the two distal phalanges of my forefinger into the orbit, and while its palmar surface pressed upon the orbital plate, its dorsal surface did not touch the eyeball, which was lying beneath it.

Two smaller cysts were found, one beneath the angular process of the frontal bone, behind and above the lachrymal gland ; the other almost wholly in the lid. The lachrymal gland was held in the midst of these three cysts and was divided irregularly into several portions, but I was unable to determine whether this division was the result of wounds received during the former operation or of degeneration due to the pressure of the cysts.

The cyst walls were separated as thoroughly as possible from the neighboring tissues until a mass was formed of cyst wall and lachrymal gland, having a pedicle attached to the conjunctiva near the retrotarsal fold, close to which it was divided. It was then believed by all who witnessed the operation that no trace of the lachrymal gland had been left in the orbit.

The wound was thoroughly cleansed with a boro-salicylic solution, and closed with three silk sutures. The eye was then replaced in its normal position in the orbit, and a moderate pressure was applied by means of a sublimate dressing.

The wound healed readily except near its outer angle, where a sinus persisted for about six weeks. Shortly after its closure evidence of a re-collection of fluid appeared in the inner part of the lid.

On the 8th of July I found that this collection had increased considerably and was causing some pain, so I passed a Graefe knife upward and backward through the retrotarsal fold into the cyst and drew off a quantity of fluid. Since then the patient has been quite comfortable, suffers no pain, and is able to read rather coarse newspaper print. She has a reasonable supply of tears in the eye, and claims to have considerable epiphora when exposed to a bright light or a strong wind.

Tumors of the lachrymal gland are so rare that very little space is accorded them in the majority of the text-books, and mention of them in general literature is not common. Among these tumors the most frequently met with perhaps is that known as dacryops, a condition closely analogous to ranula, caused by the closure of one of the ducts leading from the gland. This closure causes the retention of the tears in a sac, formed at first by the walls of the duct, later by the surrounding connective tissue, which becomes more and more distended as the lachrymal gland continues to add to the imprisoned secretion. This may continue until the eyeball becomes pressed downward and forward upon the cheek, giving way to the cystic tumor which occupies the upper part of the orbit. When this is the condition, a bluish, translucent, cyst-like tumor, covered only by the conjunctiva, may be seen on eversion of the lid.

The best mode of treatment for this affection seems to be a little doubtful. In an uncomplicated case puncture of the sac through the conjunctiva and maintenance of the patency of the opening so formed would appear to me the preferable method. Simple evacuation of the cyst through an incision in the lid with or without cauterization of the sac, or an attempt to dissect out the cyst without removal of the lachrymal gland cannot be productive of good. The excretory ducts will be more firmly and completely closed than before by the formation of cicatricial tissue, while the gland itself will retain its normal activity, so that either a permanent external fistula will result or the cyst will rapidly recur, and the final condition of the patient will be worse than the first.

If the gland be removed with the cyst we may reasonably expect no recurrence and no fistula. Still, although there will be sufficient mucous secretion to keep the conjunctiva moist after its removal, the lachrymal gland has its functions and should not be removed so long as there is a hope of successfully treating the cyst in another manner.

In cases which have become complicated by previous attempts at surgical interference or otherwise it may not be best to delay the radical operation. In my own case I be-

lieve that puncture would have utterly failed at the time I first saw the patient. It might have evacuated one or possibly two of the cysts and given temporary relief, but I feel certain that the third cyst which extended up into the lachrymal fossa would not have been touched, would have caused a quick recurrence of the symptoms and would have necessitated the radical operation at a later date.

It is difficult for me to account for the recurrence which really did take place except by the theory that a small accessory gland was present and overlooked in the wall of the cavity. The dissection was conducted in the most careful manner. The lachrymal gland was dislocated into the cavity formed by the cysts, and was separated by them from the walls on every side. The cysts were separated from the muscular tissue before they were opened, and were afterwards scraped as thoroughly as possible from the bone. In this manner a mass was formed which was attached nowhere except to the conjunctiva at or near the mouths of the excretory ducts, and no portion of the mass was left when this pedicle was divided. If the mass had been cut through and a portion left when the incision through the pedicle was made, it would have certainly been detected a moment later when I examined the stump. It is possible that a portion of the gland may have been cut off during the previous operation, become widely separated from the rest by means of the growth of the cyst, and been left unnoticed in the wall of the cavity. A portion so cut off would act as an accessory gland, and could not readily be differentiated from it. Its presence in this case is hardly to be regretted so long as an opening through the conjunctiva is patent, as it seems to be performing the functions of a lachrymal gland as well as can be desired.

PUNCTURED WOUND OF THE SCLERA; RECOVERY WITH GOOD VISION.

By W. E. BAXTER, M.D.,

SURGEON TO EASTERN MAINE EYE AND EAR INFIRMARY, BANGOR, ME.

Mr. W. age twenty-seven, American engineer, was brought to my office October 7, 1890, by Dr. Edmunds of this city. He states that half an hour before I saw him he was struck on the outer part of the right eye by a piece of broken glass from the water-gauge from his engine. On putting his hand to his eye he found, as he states it, "part of his eye running out"; he then put his handkerchief over his eye, and held it there until he got to my office.

An examination showed a large vertical wound in the eyeball, 2 *mm* from the outer border of the cornea, 8 *mm* in length and 3 *mm* in width, through the conjunctiva and sclera, large enough to admit the end of an ivory-handled eye instrument; through this wound the vitreous was protruding; there was a loss of scleral tissue at the middle part of the wound. The anterior chamber was partly filled with blood, and the cornea collapsed.

After cleansing the wound, the conjunctiva was dissected from the sclera for some distance around the wound; the sclera was brought together with the silk sutures, and the conjunctiva brought together, so sealing the wound in spite of the loss of scleral tissue. Having no catgut fine enough for the sutures, silk had to be used, but no trouble was found in removing these through the conjunctiva.

Four days from this time the stitches were removed, perfect union having taken place. The anterior chamber was cleared from blood. The vitreous was somewhat hazy, but the patient could distinguish objects, the color of one's eyes, etc. At the end of two weeks the eye was free from irritation, and the vision $\frac{6}{12}$ and improving; since then the patient has not been seen.

NOTE CONCERNING ASTIGMATIC BIFOCAL LENSES.

By GEORGE M. GOULD, Philadelphia, Pa.

CONCERNING the opinion of Mr. Percival, that the bifocal lenses are not suitable for astigmatic patients, I would say that I never make any difference in such cases, and that the great majority of my presbyopic patients are astigmatic. I have never heard a complaint from them, and cannot understand why our esteemed colleague finds the lenses unsuitable. I have patients wearing sphero-cylinders, both plus and minus, at all axes, and sometimes the astigmatism running as high as six dioptries, and with perfect satisfaction. Thinking the explanation may consist in the method of manufacture, I have sent Mr. Percival a sample of a pair of lenses that has been worn for six months, of the following refraction:

Distance { O. D., — sph. 2.25 D., ⊃ — cyl. 3.00 D. ax. 95°.
O. S ., — sph. 5.00 D., ⊃ — cyl. 1.25 D. ax. 90°.

Reading { O. D., + sph. 0.50 D., ⊃ — cyl. 3.00 D. ax. 95°.
O. S., — sph. 3.00 D., ⊃ — cyl. 1.25 D. ax. 90°.

ON SOME OPHTHALMIC SEQUELÆ OF THE INFLUENZA EPIDEMIC.

By W. M. BEAUMONT,

SURGEON TO THE BATH EYE INFIRMARY, ENGLAND.

AFTER so wide-spread an epidemic as that of last winter, one from which no nation, class, age, or sex seems to have been exempt, and one in which the after depression was so marked a feature, it is not surprising to find that, though the disease has now departed, it has left behind traces of its havoc. All sorts and conditions of aches and pains, forming a heterogeneous mass of nondescript symptoms, are dated from an attack of influenza. In many cases there certainly is, whilst in others there certainly is not, a link of cause and effect, and yet again in a large number of instances one is left in doubt as to whether the attack of influenza is a *vera causa* of, or a mere precurrent casualty to, the subsequent ailment. No class of sequelæ seems to be more frequent than the ophthalmic; and no variety of eye-disease, if we may believe our patients, but what may follow an attack of influenza. I have seen patients, the victims of senile cataracts, who accounted for their blindness by such an attack, although on being questioned they have granted that the sight was not good previous to the illness. In the following list of cases I have only admitted such as seemed to be so closely coincident with the attack of influenza that there might be a fair presumption, or at least the possibility, of a relationship of cause and effect; it must not, however, be forgotten that ophthalmic sequelæ often follow an illness, although that illness is not one that would

be expected to interfere with the function of the eye. As far as my limited experience goes it seems, as has been pointed out by Fage,[1] that the later attacks of influenza, that is, those which occurred when the epidemic was on the wane, were more prolific in producing ophthalmic sequelæ than those attacks which occurred at the beginning of the outbreak. I have notes of twenty-two cases, in all of which some form of eye-disease accompanied or supervened upon an attack of influenza, and of these cases I append the following brief notes:

Case 1. *Blepharitis and Hypermetropia.*—A woman, æt. 47, was laid up with influenza in March, and as soon as she got about again, which was in the first week of April, the lids became red and painful and sewing was impossible. She did not, however, put herself under treatment until May, when a bicarbonate of soda lotion and + 2 D glasses quickly cured her.

Case 2. *Hypopyon-Keratitis.*—A woman, æt. 66, took to her bed on account of influenza in February, and whilst ill with it the left eye became "inflamed" and very painful. She came to the Bath Eye Infirmary in April, when the anterior chamber was half full of pus and vision barely p. l. Paracentesis was performed, but it was a month later before the eye became quiescent.

Case 3. *Paralysis of Accommodation.*—A man, æt. 57, had an attack of influenza in February. Whilst convalescent he discovered that he could not see distinctly either at a distance or near, but an attack of diarrhœa coming on, which lasted nearly four weeks, he took very little notice of the defect of vision. When he came to the Eye Infirmary on May 15th the pupils were found to be very sluggish to light and inactive to accommodation (B E $\frac{5}{60}$ + 3 = $\frac{5}{6}$ p. No. 19 J. + 8 = 1 J). There was no history of sore-throat or syphilis, and vision was the same under atropine. He improved a little during the next two months, and was then lost sight of.

Case 4. *Blepharitis, Hordeola, and Mixed Astigmatism.*—A girl, æt. 9, was laid up with influenza before Christmas, and a week after she recovered the eyelids became red, sore, and covered with "wisps." She remained in much the same condition until May, when a moderate degree of mixed astigmatism was corrected

[1] Complications oculaires de la Grippe.—*Archives d'Ophtalmologie*, t. x., p. 146.

and the lids got well. She had never had any thing the matter with the lids before the attack of influenza.

CASE 5. *Muscular Insufficiency, Heterophoria.*—A lady, æt. 65, had an attack of influenza in March and a relapse in April, and this again was followed by an attack of bronchitis in June. Previous to her illnesses she read easily with + 2 D, but she was not able to use her eyes comfortably afterwards. In September she was found to read, with + 3 D for the R and + 2 D for the L, J. 1 at 33 *cm*, when the eyes were used separately, but with binocular vision lenses were of very little assistance to her as the type became confused and the eyes tired at once. On making her converge it was found that a quivering of the eyes resulted, and when either eye was abducted extremely the same happened. Prisms were of no assistance to her, but under ammoniated citrate of iron she eventually recovered.

CASE 6. *Chronic Conjunctivitis.*—A man, æt. 37, was confined to the house with influenza for three weeks in January. On the first day that he went outside after the attack he "caught cold in the eyes," and was in consequence obliged to keep in-doors for a fortnight. The disease then ran a chronic course for three months, after which he came to the Bath Eye Infirmary (May). The conjunctivæ, both ocular and palpebral, were found to be inflamed, and there was a good deal of muco-purulent discharge as well as pain, this latter being referred to the back of the eyes. The iris was not affected, and his vision was normal.

CASE 7. *Muscæ.*—An anæmic girl of 21, who said her sight had always been weak, was ill with influenza in January, and ever since she had been annoyed by muscæ. Her vision was good, the refraction emmetropic, and she improved rapidly with iron and arsenic.

CASE 8. *Catarrhal Conjunctivitis.*—A woman æt. 38; never had any thing the matter with her eyes until she was laid up with influenza last February. A week after its onset the corners of her eyes, she said, became painful and inflamed. There was no error of refraction. V = $\frac{6}{6}$.

CASE 9. *Internal Strabismus, Diplopia.*—A woman, æt. 49, was laid up with influenza and sore-throat in January. In April she came to the Eye Infirmary complaining of homonymous diplopia. The R was found to be slightly converged. Vision, $\frac{6}{6}$ with each eye. The diplopia was neutralized by a prism of 5°, base outwards (Landolt's series). The optic discs were normal, T n.

With + 2.5 D she read J 1 easily. After two months' treatment with iron and strychnine she quite recovered.

CASE 10. *Paralysis of the Accommodation.*—A woman, æt. 40, had a severe attack of influenza at Christmas, followed by a relapse, or, perhaps more correctly, a second attack, in February, after which she noticed that her sight was dim. There was a history of syphilis. In June the left eye was found to be amblyopic. (It had been operated upon for strabismus in childhood.) R E, $\frac{6}{60}$ + 7 D = $\frac{6}{6}$ and J 16. With + 10 J 1. No mydriasis. The pupils act to light but not to accommodation.

CASE 11. *Glaucoma.*—A lady, æt. about 60, was laid up with influenza about Christmas, and her eyes at the same time became "irritable." They did not get any better when she convalesced from the attack of influenza, and when seen in April she was in the following condition: The R pupil was dilated, the media muddy, T + 2, and she could only see shadows. The L pupil was not dilated, but was extremely sluggish; she saw halos round the candle; the anterior chamber hardly existed; T + 1 and vision $\frac{6}{36}$. By the ophthalmoscope the disc was seen to be cupped. Double iridectomy was followed by no improvement in the R, but in the L vision became $\frac{6}{12}$.

CASE 12. *Conjunctivitis and Hypermetropia.*—A farmer, æt. 19, was confined to bed with influenza in March. In June he came complaining that he had had visual troubles ever since. His refraction was found to be H. = + 1 D, and there was in addition some irritable follicular conjunctivitis.

CASE 13. *Episcleritis.*—A man, æt. 61, had influenza in March, and at the same time pain and lachrymation in the R eye. When seen in May there was a patch of episcleritis just external to the corneal limbus. His refraction was emmetropic.

CASE 14. *Asthenopia, Hypermetropia.*—A lady, æt. 25, was laid up with influenza last February, after which she was unable to follow her employment as a teacher in consequence of headache and blurring when she attempted to read. In July she was found to have Ht. 3.5 D. With lenses + 1.5 she was able to resume work at once.

CASE 15. *Conjunctivitis and Hypermetropia.*—A woman, æt. 28, was attacked by influenza last Christmas. This was followed by photophobia and conjunctivitis. She applied for treatment in April, and was quickly relieved by boracic fomentations and + 1 D spectacles for near vision.

CASE 16. *Phlyctenular Conjunctivitis and Myopia.*—A woman, æt. 45, was laid up with influenza last February. She came to the Eye Infirmary in April, complaining of photophobia due to phlyctenular conjunctivitis. She was myopic (R — 1 D, L — 2.5 D), but had never worn glasses. Under treatment she slowly convalesced during the next five weeks, due attention being paid to the error of refraction.

CASE 17. *Blepharitis, Hypermetropia.*—A lady, æt. 44, suffered from typhoid four years ago; since then the eyes have been sore and red, and occasionally they have discharged matter. Last January she was laid up with influenza, and since then the eyes have been very much worse, and she has had difficulty in reading small print. When seen in June there was a good deal of conjunctivitis and lachrymation; her refraction was hypermetropic, 1 D. Boracic lotion and + 1 D glasses quickly relieved her symptoms, and in July she was quite well.

CASE 18. *Asthenopia, Hypermetropia.*—A lady's maid, æt. 21, had to give up work in the last week of January in consequence of an attack of influenza. She came to the Eye Infirmary in April, saying she had not been able to sew since her illness. On examination there was found to be 1.75 D of hypermetropia. With + 1 D she was able to resume work at once.

CASE 19. *Asthenopia, Hypermetropia.*—A gentleman, æt. 43, was laid up with influenza in February, followed by aching in the balls of the eyes whenever he attempted to read. He had never suffered thus before and he had never worn glasses. The correction of his Ht. (R + 2, L + 3) relieved all the symptoms.

CASE 20. *Blepharospasm, Anisometropia.*—A young lady, æt. 26, was laid up with influenza in February, and as soon as convalescence was established she found that she could not use her eyes for near work in consequence of the continuous blinking of the lids. There was no disease of the teeth. Shower-baths had been tried in vain. When seen in September, seven months after the blepharospasm, her refraction was found to be, R, Ht. 1 D; L, M 1 D, the right eye being used for distant vision and the left eye for near vision. The refraction was corrected and both eyes brought into use for all purposes. Cocaine was dropped into the eyes at regular intervals and bromide of potassium administered internally. She at once began to improve and within a fortnight the spasm was scarcely noticeable.

CASE 21. *Corneal Ulcer.*—A cook, æt. 21, was admitted into

the Bath Eye Infirmary on April 29, 1890 with a sloughing ulcer of the cornea, which dated from an attack of influenza in March. Its onset, she said, was sudden one night, the pain waking her up. The ulcer was treated with boracic massage and healed up in about three weeks.

CASE 22. *Glaucoma.*—A weaver, æt. 74, was attacked by influenza in February, and before he got over it the R eye became very painful and inflamed. He neglected it till May 20th, when the condition was T + 1, mydriasis, no vision, details of fundus invisible. An iridectomy was performed and the pain, tension, and inflammation gradually subsided. He was discharged June 5th.

In these cases there seems to be something more than mere coincidence in the relationship of the eye affection to the attack of influenza. Troubles of the accommodation are so frequent a sequel of other debilitating diseases—such as typhoid, relapsing fever, etc., that it is scarcely a matter of surprise to find influenza followed by ophthalmic complaints. Corneal ulcers, keratitis, iritis, etc., are possibly instances of what Mules calls tropho-neuroses. In hypermetropia the ciliary muscle, which in health may have been sufficient, by an effort of accommodation which was inappreciable, to bear the ordinary daily strain, can, after an exhausting disease, such as influenza, no longer fulfil its duties. The accommodation, which had hitherto been capable of neutralizing the error of refraction, is now unequal to the task, and the tendency is for the Ht. to be converted into Hm. As a consequence the usual asthenopic and accommodative symptoms common to the error are manifested, and the equilibrium can only be re-established by resorting to correcting lenses.

But though errors of refraction, plus post-influenza debility, may result in accommodative troubles, yet it is evident that ocular disease cannot be accounted for in this way in those cases in which there is no error of refraction, nor in those cases in which the resulting disease is not one that has any connection with the refractive or accommodative apparatus. It must, however, be difficult to say in many cases what the true relationship really is. Take, for instance, cases

11 and 22 in the above series, what are the successive pathological steps which, beginning in influenza, terminate in glaucoma? We know that influenza leaves troops of sequelæ, or rather we know that it is usual to account for many minor illnesses that have been preceded influenza by fathering them upon the epidemic. We know too that great physical and mental depression characterize influenza, and we know also that glaucoma frequently follows depression whether of body or mind, but the exact process is too subtle for analysis, and it is less easy to *account for* than it is to *know*.

A CASE OF INTERNAL STRABISMUS WITH CROSSED DIPLOPIA.

By A. B. OSBORNE, M.D.,

OPTHALMIC AND AURAL SURGEON, CITY HOSPITAL, HAMILTON, ONT.

Early in the present year J. V., æt. 21, came to me on account of a slight internal strabismus. Two years previously a competent oculist had divided the internal rectus of each eye, resulting in a moderate improvement.

The vision in the left eye was $\frac{6}{9}$, right $= \frac{6}{6}$. He could fix with either eye indifferently, although he most frequently used the left. Under atropine R V $= \frac{6}{36}$; $+$ 1.5 D $= \frac{6}{6}$ partly, L V $= \frac{6}{18}$; $+$ 1.5 D $= \frac{6}{6}$, fundi normal: this correction was ordered. After wearing the glasses for three weeks, with the eyes under atropine—no diminution of the squint having taken place—I divided the right internal rectus, leaving the eyes apparently straight. He now complained of diplopia, which proved upon examination to be crossed, any attempt to fuse the double images causing the strabismus to return; and when he reported the images fused the squint was as great as before the operation. By the cover test there was a slight but distinct movement outward, in order to fix, showing that there was still a convergent squint, notwithstanding the crossed diplopia. The strabismus now gradually returned to about the condition in which I first saw it, with the exception that he could produce crossed diplopia at will. A few days after the operation, I noticed for the first time a difference in the horizontal planes of the eyes, notwithstanding which he reported the double images on a level.

The strabismus having now resumed its original position, I undertook what proved to be a most arduous task, viz., to teach him to have homonymous diplopia; at the end of a week's practice he was able to produce occasional homonymous images, but could not hold them long, as they became crossed. The closest attention to his eyes revealed no movement at the time

when he declared the diplopia to change from homonymous to crossed, although the images, according to his statement, must have moved a distance of nearly six feet. With crossed diplopia the images were on a level and steady; with homonymous diplopia the right was much the higher and unsteady. Two weeks' practice resulted in almost constant homonymous diplopia, an 8° prism bringing the images about level; but this could not be measured accurately as the images became crossed when brought near the same level.

One month after the first operation I divided the left superior rectus. For a few days he had little control over the images, the diplopia becoming crossed in spite of him; but he noticed that the homonymous images were about on the same level, while there was nearly the same difference between the height of the crossed images as had previously existed between the homonymous. A few days later, the eyes having become settled, he had continuous homonymous diplopia, the right image being still slightly higher than the left, 1° prism bringing them even.

I now began to practise approximating the homonymous images with prisms, and encountered great difficulty, even a weak prism at first causing the images to cross. After a month's practice he thought a pair of 5° prisms about fused the images, but that belonging to the right eye was unsteady and floated about. While using these prisms he became aware of a third image, which came into view when the homonymous images were brought close together. This third image came into view when he fixed with either eye and was always crossed, belonging to the deviating eye, viz., when fixing with the left the third image was below and on the left, when fixing with the right the third image was above and on the right, thus corresponding to the original crossed images, their plane having been altered by the division of the superior rectus. The triplopia was constant while wearing a pair of 5° prisms.

Having now accustomed himself to the proximity of the homonymous images, and being able to hold them without crossing, I divided the left internal rectus. After this operation the images were so close that owing to the unsteadiness of the right they occasionally merged into one. It is noteworthy that although the tendency to fusion of the crossed images had been strong enough to cause a recurrence of the squint after the first operation, yet, notwithstanding the proximity of the correct images and my

constant injunctions to endeavour to fuse them, he not only has no tendency to fusion, but is unable to maintain single vision when they become fused of their own accord.

The present condition is almost similar to that just after the last tenotomy; the images partly overlap each other, the right is still rather unsteady and by alternately covering each eye there is a very slight motion of adjustment. He is learning to ignore the third image. There is no tendency to fusion.

It is worthy of remark, that the functions of the macula were assumed by eccentric portions of each retina, and not by that of the deviating eye alone.

In many respects this case is a corroboration of Stevens' remarks upon strabismus in the December number (1889) of these ARCHIVES.

A REPORT OF TWENTY-FIVE CATARACT EXTRACTIONS, WITH REMARKS.

By JAMES L. MINOR, M.D., Memphis, Tenn.

I HAVE collected the notes of twenty-five consecutive cases of cataract operated upon by me during the past few years. The first eleven cases were treated at the New York Eye and Ear Infirmary during my connection with that institution[1]; the remainder—fourteen cases—were treated in Memphis. Of the 25 cases operated upon, 13 men and 5 women were white; 3 males and 4 females were colored.

The oldest was 82 years; the youngest, 41; the average, 63. The results were uninfluenced by age.

The general health was good or fair in all.

The cataract was mature in 22 cases, and hypermature in 3. Equally good results were obtained in the two conditions.

The right eye was operated upon in 12 cases, and the left in 13.

The greatest duration of cataract was 23 years; the shortest, 6 months; the average, 2 years.

All eyes were flushed with a saturated solution of boric acid before the operation. No other antiseptic precautions were practised at this time further than scrupulous cleanliness.

Preliminary iridectomy, with trituration of the lens, was practised in 4 cases—good results being obtained.

[1] The reports of these cases were copied from the records of the New York Eye and Ear Infirmary, for me, by the then House-Surgeon, Dr. F. N. Lewis.

TABULATED REPORT

Name, Nativity, and Residence.	Age.	General Health.	Corneal Diameter.	Size and Dilatability of Pupil.	Quality and Duration of Cataract.	Functional Examination.	Date of Operation.	Operation. Method and Incidents. Anæsthetics.
Oliver Dexter, Jersey City. Case I.	69	Good, except emaciated.	Normal.	Normal.	O. S. 2 years.	Normal.	Aug. 8, 1881.	Ether. Graefe's mod. lin. section; medium hemorrhage into anter. chamber. Iridectomy large. Cystotomy vertical, pressure required to cause lens to escape. Some cortical remaining which was removed. Some blood left in anter. chamber.
John Welsh. Case II.	60	Fair.	N.	N.	Senile. O. D.	N.	June 22, 1883.	No ether. Graefe's mod. linear upwards. Section large. Free iridectomy. Peripheral capsulot. Lens dislocated down and backwards. Delivery with spoon. Slight escape of vitreous.
Amanda Jackson. (col.) Case III.	60	Fair. Syphilitic.	N.	N.	Mature. O. S.	N.	July 13, 1883.	Ether. Graefe's mod. linear upwards. Small incision. Medium iridectomy. Good deal cortical. Extrusion easy. Vitreous presented in wound, did not escape. No accident.
Henry Lutja. Case IV.	72	Poor. Phthisical.	N.	N.	Mature. O. D.	N.	July 16, 1884.	Chlor. and ether. Graefe's mod. linear upwards. Section small. Preliminary iridect. (Förster), March 28, 1884. Peripheral cystotomy. Abundant soft cortical. Delivery easy. Some cortical left.
Catharine Hamstahl. Case V.	49	Good.	N.	N.	Mature. O. D.	N.	Oct. 13, 1884.	Cocaine 2 %. Graefe's mod. lin. upwards. Section large. Förster, Sept. 1, 1884. T. Cystotomy. Delivery easy; much cortical remaining; no pain. Boric acid washing; anæsthesia perfect.
Wm. McCormick. Case VI.	70	Good.	N.	N.	Mature. O. S.	N.	Nov. 21, 1884.	Cocaine 4 %. Peripheral incision upwards. Section medium. Small iridectomy. Slight hemorrhage from iris. Peripheral capsulotomy. Delivery slow. No accident.
Charles O'Blimis. Case VII.	58	Good.	Normal.	Normal.	Mature. O. D.	Normal.	Dec. 5, 1884.	Cocaine. Peripheral section upwards. Corneal wound large. Förster, Nov. 10, 1884. Peripheral cystotomy. Delivery easy. Pupil clear. No accident. Perfect anæsthesia.
Thomas H. Evans. Case VIII.	82	Good.	N.	N.	Mature. O. S.	N.	Dec. 5, 1884.	Cocaine 4 %. Peripheral section upwards. Corneal incision large. Broad iridectomy. Hemorrhage into anterior chamber. Peripheral cystotomy. Delivery easy. Complete collapse of cornea. Perfect anæsthesia.

OF THE CASES.

Course of Healing Process and Treatment.	Length of Treatment.	Vision at time of Discharge. Far and Near.	Secondary Operation. Date, Kind, Course, and Result.	Ultimate Vision, with Date of Testing.	Remarks.
Aug. 11th.—Patient last night had delusion that she was being smothered to death from escape of gas into room; became quite frantic, tearing bandage off and screaming at top of her voice. She was given dose K. Br. and whiskey ʒi, which soon quieted her. Aug. 13th.—The same thing last night, and patient quite unmanageable. Iritis set in; treated with atropine. Allowed to get up and see company, and insanity disappeared. Aug. 19th.—Eye quiet, posterior synechia at lower part.	11 days.	Aug. 19. 1881. V = $\frac{8}{180}$, with + 8 D's = $\frac{20}{100}$. Sept. 28, 1881. V = $\frac{8}{180}$ + 12 D's = $\frac{20}{20}$.	March 24, 1882. With + 4 in. $\frac{20}{20}$. With + 2½ reads Sn. D. = 1 at 10 in.	$\frac{20}{20}$	
Normal. Left without permission and before vision could be taken.		V = $\frac{20}{XL}$ probably, as there was no membrane and perfectly clear pupil.			
Every thing went well until 5th day, when iritis developed on 7th day of a purulent nature. Put on hot applications and atrop. This was continued until 15th day, when process slowly subsided, leaving pupil filled with dense membrane.	18 days.	V = perception of light. Dense membrane in pupil.			
Normal.	12 days.	V = $\frac{20}{LXX}$			
Normal.	17 days.	V = $\frac{20}{LXX}$			
Normal.	16 days.	V = $\frac{20}{LXX}$ + 3$\frac{1}{2}$			
Normal.	19 days.	V = $\frac{20}{XL}$ + 10 D's.		V = $\frac{20}{XX}$ + 10 D's ⊂ + 1.50 c. Ax. 120°. Reading + 15 D. ⊂ + 1.50 D.c. at 120°.	
Wound opened on 5th day. Bandage atrop. once daily. Wound closed on 15th day. Otherwise process of healing normal.	26 days.	V = counts fingers. Dense pupillary membrane obscuring sight.	Needled Jan. V = $\frac{20}{c}$ with + 10 D. Reading + 16 D. Jan. 21, 1885.		

Name, Nativity, and Residence.	Age.	General Health.	Corneal Diameter.	Size and Dilatability of Pupil.	Quality and Duration of Cataract.	Functional Examination.	Date of Operation.	Operation. Method and Incidents. Anæsthetics.
Nathaniel Parks. Case IX.	57	Good.	N.	N.	Mature. O. D.	N.	Dec. 12, 1884.	Cocaine 4 %. Peripheral section upwards. Förster, Nov. 7, 1884. Peripheral cystotomy. Delivery easy. No accident. A. B. wash.
Mary Schlarf. Case X.	61	Good.	N.	N.	Mature. O. D.	N.	April 10, 1885.	Cocaine 4 %. Peripheral section upwards, with conj. flap. Medium iridectomy. Peripheral capsulotomy. Extrusion easy. Counted fingers. No accident.
Charles O'Blimis. Case XI.	58	Fair.	N.	N.	Mature. O. S.	N.	May 1, 1885.	Cocaine 4 %. Peripheral section upwards. Preliminary iridectomy (Förster). Peripheral capsulotomy. Extrusion easy and without accident. Counted fingers.
Mr. J. P., U. S. Male. White. Case XII.	41	Fair.	N.	N.	Hard cataract right eye. 4 years.	N.	June 29, 1886.	Peripheral section upwards. Good iridectomy. Peripheral cystotomy, and lens dislocated downwards. Vitreous presented and lens delivered with spoon. Slight loss of vitreous. Cocaine.
Capt. H., U. S. White. Case XIII.	70	Good	Normal.	Normal.	2 years. Hard cataract. Hypermature.	Normal.	Oct. 5, 1886.	Right eye. Graefe's modified peripheric linear section upward, with apex well in cornea. Good iridectomy. Peripheric cystotomy. Slight loss of vitreous, and lens delivered with spoon. Cocaine.
Mrs. R., Ireland. White. Case XIV.	65	Good.	N.	Large but otherwise normal.	6 months. Hard cataract.	N.	Feb. 13, 1887.	Right eye. Graefe's modified linear section, upward. Good iridectomy. T-shaped cystotomy. Lens large, and following its delivery was loss of vitreous. Cocaine.
S. M., U. S. Female. Colored. Case XV.	60+	Good.	N.	N.	1 year. Hard cataract.	N.	March 12, 1887.	Left eye. Graefe's modified linear section upward. Large iridectomy. Peripheric cystotomy. Delivery of lens easy and without accident. Cocaine.
B. H., U. S. Negro. Man. Case XVI.	60+	Good.	N.	N.	2 years. Hard cataract.	N.	Oct. 7, 1887.	Right eye. Operation as above. Cocaine.
H. J. T., U. S. Male. White. Case XVII.	56	Good.	N.	N.	2 years. Hard cataract.	N.	Jan. 20, 1888.	Left eye. Operation as above. Cocaine.
M. O. P., U. S. Male. White. Case XVIII.	60	Fair.	N.	N.	1 year. Hard cataract.	N.	Feb. 12, 1888.	Left eye. Preliminary iridectomy with trituration of lens one month before. Graefe's modified linear section upward. T-shaped cystotomy. Lens delivered with ease. Cocaine.
M. M., U. S. Female. Negro. Case XIX.	70	Fair.		Normal.	2 years. Hard cataract, hypermature.	Normal.	Nov. 5, 1888.	Left eye. Graefe's modified linear section upward. Large iridectomy. Peripheric cystotomy. Delivery of lens easy. Cocaine.
S. R., U. S. Male. Negro. Case XX.	65	Good.		N.	1 year. Hard cataract.	N.	Dec. 10, 1888.	As above. Right eye. Cocaine.
C. B., U. S. White. Male. Case XXI.	67	Fair.		N.	4 years. Mature cataract.	N.	Jan. 6, 1889.	Left eye. As above. T-shaped cystotomy. Delivery easy. Cocaine.

Course of Healing Process and Treatment.	Length of Treatment.	Vision at Time of Discharge. Far and Near.	Secondary Operation. Date, Kind, Course, and Result.	Ultimate Vision with Date of Testing.	Remarks.
Normal.		$V = \frac{20}{xxx.} + 10$ D. ⌒ + 1.50 D.c. ax. 125°.			
Normal.	14 days.	$V = \frac{20}{cc.}$ with + 3½. Some cortical matter + capsule in pupil.			
Normal.	38 days.	$V = \frac{20}{c} + 3\frac{1}{2}$			
Normal until 8th day, when sharp attack of iritis occurred, which yielded to treatment.	3 wks.		Membrane divided with cutting needles 2 months after extraction.	Feb. 21, 1887. $\frac{20}{30}$ with + 14^{00} D. For reading + 18^{00} D.	
Normal. Eye kept bandaged until 4th day, when lids were kept closed with adhesive plaster.	10 days.	$\frac{20}{100}$	May 30, 1886. Secondary membrane divided with sickle knife. Result good. $\frac{20}{100}$.	Nov. 25, 1887. $\frac{20}{20}$, with + 10 D. With + 14^{00} D, reads No. IV. Sn.	
Normal.	1 week.			March 18, 1887. $\frac{20}{20}$ with + 12^{00} D. With + 15^{00} D. sees to thread needle.	
Normal.	1 week.	$\frac{20}{100}$	April 20, 1887. Membrane divided with knife-needle. Good result.	May 10, 1887. $\frac{20}{100}$ with + 11 D. Small type with + 15 D.	To report later for another division of membrane.
Normal, except slight iritis on 4th day, which yielded to treatment.	2 weeks			$\frac{20}{20}$ with + 10 D. Reads with 14 D.	
Normal.	10 days.			March 12, 1888. $\frac{20}{20}$ with + 9 D. S. ⌒ + 1.75 D. C. at 180°. Reads No. II J with + 14 D. S. ⌒ + 1.75 D. C. at 180°.	
Normal.	10 days.			May 10, 1888. $\frac{20}{20}$ + with + 10 D. S. ⌒ + 1.50 D. C. at 125°.	
Normal. Slight iritis on 5th day, which yielded to atropia and warm-water bathing.	2 wks.		Membrane divided with cutting-needles about two months after extraction.	Dec. 10, 1888. $\frac{20}{20}$ with + 12 D. For reading, + 15 D.	
Normal.	10 days.			Jan. 15, 1889. $\frac{20}{100}$ with + 11 D. For reading + 15 D.	To report later for secondary operation.
Normal.	1 week.			Feb. 27, 1889. $\frac{20}{20}$ + 10 D. For reading + 14 D.	

Name, Nativity, and Residence.	Age.	General Health.	Corneal Diameter.	Size and Dilatability of Pupil.	Quality and Duration of Cataract.	Functional Examination.	Date of Operation.	Operation. Method and Incidents. Anæsthetics.
J. F., U. S. Male. Colored. Case XXII.	60	Good.	N.	N.	23 years.	N.	March 7, 1889.	Right eye. As above, with peripheric cystotomy. Cocaine.
Mrs. A. C. B., U.S. White. Case XXIII.	77	Fair.	N.	N.	4 years. Mature cataract.	N.	April 9, 1889.	Left eye. Operation as above. Cocaine.
Mrs. O'B., U. S. White. Case XXIV.	70	Good.	N.	N.	1 year. Mature.	N.	Oct. 10, 1889.	Left eye. As above. Cocaine.
J. R., U. S. Colored. Female. Case XXV.	62	Good.	N.	N.	3 years. Hypermature.	N.	April 4, 1890.	As above. Left eye. Cocaine.

Course of Healing Process and Treatment.	Length of Treatment.	Vision at Time of Discharge. Far and Near.	Secondary Operation. Date, Kind, Course, and Result.	Ultimate Vision, with Date of Testing.	Remarks.
Normal.	2 wks.			May 8, 1889. $\frac{20}{20}$ with + 11 D. For near work + 13 D.	
Normal. Slight iritis about 5th day. Eyes closed with adhesive plaster after 5th day.	10 days.			May 28, 1889. $\frac{20}{20}$ with + 7 D. For near work + 10.	
Normal.	1 week.		Needled Nov. 16th.	Dec. 13, 1889. $\frac{20}{20}$ with + 11 D, ⌒ + 1 D.c. at 140°. For reading + 14 D with above cylinder.	
Normal.	10 days.			April 28, 1890. + 12^{22} D. S, V = $\frac{20}{20}$? + 15^{22} S. Reads I Sn. at 10".	

With that exception, the operation known as Graefe's modified linear extraction was employed in all cases.

A good free iridectomy was obtained in every instance.

Peripheral cystotomy was performed in 18 cases; T-shaped in 6, and vertical in 1.

The lens was dislocated during the cystotomy in 2 cases, with slight loss of vitreous, and delivery was effected with a spoon in each instance, giving good results.

Vitreous escaped in 2 other cases, in one of which the lens was removed with a spoon, and good results obtained.

One case was operated upon without an anæsthetic; ether was employed in 2, chloroform and ether in 1, and cocaine in 21.[1]

The compress bandage was employed in all cases, and, in most instances, it was continued as long as it was desired to keep the lids closed, or about a week, when a shade was substituted. In a few cases where the bandage was uncomfortable it was removed altogether, and the lids closed with isinglass plaster and the eyes protected with a wire-cloth shade.

It has always been my habit to dust pulverized boric acid freely over the pad which lies next the eye and underneath the cotton compress, when applying the compress bandage. The moisture which escapes from between the lids dissolves the acid as it does so, and in that way an aseptic condition is kept up.

The healing process was normal in 17 cases.

Iritis, about the 5th day, occurred in 7 cases. This yielded readily to treatment in all but 1, in which a dense pupillary membrane formed.

The wound opened on the 5th day in 1 case, but healed and gave a good result under proper treatment.

A mild form of insanity appeared on the 3d day in 1 case, which was probably dependent upon the new surroundings, the confinement, the maintenance of the recumbent posture,

[1] It may be interesting to know that case No. 5 in this exhibit was the first cataract extraction performed in the United States under the influence of the, then, new anæsthetic, muriate of cocaine. See *New York Medical Record*, October 18, 1884.

and the bandage, for it all disappeared when these conditions were rectified.

The average duration of treatment was 14 days.

A secondary operation was performed in 7 cases—6 having had peripheric, and 1 vertical, cystotomy.

Four cases were to return for a secondary operation, but failed to report.

Twenty-four cases had useful vision restored, and a large percentage of these saw almost as well as they had ever done.

One case only was not benefited by the operation, for a dense membrane occupied the pupil and coloboma. Useful vision could probably have been restored by a secondary operation, but the patient did not return for it.

3	cases	had	vision	of	$\frac{20}{20}$
3	"	"	"	"	$\frac{20}{30}$
2	"	"	"	"	$\frac{20}{40}$
4	"	"	"	"	$\frac{20}{50}$
6	"	"	"	"	$\frac{20}{70}$
4	"	"	"	"	$\frac{20}{100}$
2	"	"	"	"	$\frac{20}{200}$
1	"	"	"	"	P. L.

A CASE OF HEMORRHAGE INTO THE VITREOUS AFTER A CATARACT EXTRACTION.[1]

By H. KNAPP.

MR. PRESIDENT: When at the last meeting of this society, in the discussion on hemorrhage into the vitreous after cataract extraction—so judiciously introduced by yourself—you asked me my experience on this subject, my answer was: "I have never seen a case, either in my own practice or in that of anybody. I consider this only as a lucky chance, for, according to the usual course of events, I may have two cases the next month." What I had apprehended has, in part at least, but too soon occurred.

On November 1, 1890, I removed a Morgagnian cataract from the left eye of Mrs. Ann Corcoran, a seventy-year-old woman of this city. She perceived the light of a candle all around the eye, but was not able to localize it anywhere, a condition not unusual in milky cataract, you know, and not always connected with serious changes in the deeper structures of the globe. The eyeball, even after thorough cocainization, was hard, and I said that I probably would have to combine the extraction with an iridectomy. After a normal upper section, I opened the capsule under the upper portion of the iris, whereupon the anterior chamber was flooded with a milky fluid. I expelled the very small brown nucleus without difficulty, gave the eye a few minutes' rest, and then cleansed the anterior chamber by gentle rubbing with the lower lid. The iris fell back, the pupil was central and round, and the patient counted fingers correctly and readily. I instilled eserine, but when I re-inspected the wound, about a minute later, in order

[1] Read before the Section of Ophthalmology at the New York Academy of Medicine, November 17, 1890.

to bandage the eye, I found that by the least motion of the lid the iris would push toward the wound. I therefore made a small iridectomy, which was done without difficulty and without bleeding. I should mention that no bleeding occurred during the whole operation. In adjusting the corners of the coloboma, I noticed that a bead of vitreous had a tendency to present in the centre of the wound. Under gentle pressure with a pad of absorbent cotton the eye was kept closed for a few minutes, but when opened again a broader bead of vitreous crowded into the section, yet without protruding. I said to the by-standers this looked as if intraocular hemorrhage would occur. A regular compressive bandage was applied, and the patient put to bed. She complained of considerable pain in her eye. I told her this was not unusual, and she would soon feel easier. So she did, and I went into another room to perform some other operations. In about half an hour the nurse reported that the old woman felt more pain, had vomited several times, and blood flowed through the bandage down her temple. I removed the dressing, which was soaked with blood, and found a large clot of blood, with here and there some viscid soft liquid, protruding through the palpebral fissure. On gently raising the upper lid, I saw that the clot was lying in the widely gaping corneal section. I removed it as well as I could, dropped a solution of bichloride of mercury, 1–10,000, into the conjunctival sac, washed the outside of the lids carefully with the same solution, and applied an antiseptic dressing (sublimate gauze and absorbent cotton moistened with a 1–5,000 solution of corrosive sublimate), held in position by an elastic flannel roller. The pain soon subsided, and there was no further hemorrhage.

The next day, on changing the dressing, which was still soaked with blood but dry, a clot lay in the opened section. It was carefully removed with a pair of forceps. There was no swelling of lid or conjunctiva, and the cornea was clear ; the anterior chamber was full of blood. After a solution of corrosive sublimate had been instilled, the same dressing was applied as the day before.

The dreaded suppuration did not occur. The patient felt comfortable, the blood-clot in the wound contracted, the section closed, the cornea remained transparent, and the blood in the anterior chamber gradually absorbed.

At the end of two weeks after the operation the patient desired

to be transferred to some other hospital. The wound being substantially healed, she was discharged with a blind but painless and non-disfigured eye.

The microscopic examination showed the clot which had been hanging out of the corneal section to consist of a mass of blood corpuscles, in which vitreous, lens capsule, and pieces of retina, especially of the pars ciliaris, were embedded.

What caused the retrohyaloid hemorrhage in this case after a perfectly smooth extraction I am at a loss to surmise. As to its course and termination, this case has gone against the rule, which is suppuration and panophthalmitis. This unfortunate issue has been noticed with such frequency as to induce some operators to advise immediate enucleation when hemorrhage into the vitreous sets in. In the above-described case the hemorrhage was as copious as it could be, and evidently originated in the posterior segment of the eye, for it expelled vitreous, retina, and lens capsule. Nevertheless, the recovery was by primary union. As, for practical purposes, we may confidently consider all suppuration caused by the action of pyogenic germs, suppuration will not occur in any wound as long as we can keep pyogenic germs out. Consequently an extraction wound, even if complicated with severe intraocular hemorrhage, is not necessarily doomed to suppurate. I would therefore treat such cases exactly as the one detailed above: remove the blood carefully, wash the conjunctival sac out with a mild antiseptic, sterilize the outside of the lids in like manner, and apply an antiseptic dressing. Change the dressing once or twice daily, according to the presence of discomfort and more or less discharge. If the beginning of panophthalmitis manifests itself, enucleate without delay, otherwise spare the eye.

CASE OF HERNIA OF IRIS OCCURRING ON THIRD DAY AFTER CATARACT EXTRACTION WITHOUT IRIDECTOMY; HERNIA REPLACED; RECOVERY.

By HERBERT HARLAN, A.M., M.D., Baltimore.

THE following case bearing on the time of complete healing of a corneal wound, and on the liability to prolapse of the iris, is perhaps of sufficient interest to justify being put on record.

A somewhat similar case resulting from an injury on the sixth day is reported by Dr. Knapp in THESE ARCHIVES Vol. XVII., page 55 (case 67).

M. Y., æt. fifty-eight, having a mature cataract in the left eye and some clouding of the lens in the right, was operated under cocaine anæsthesia July 16th; the left lens being extracted through large upward peripheral incision without iridectomy. Operation smooth. A solution of eserine was instilled, and the left eye closed with strip of isinglass plaster, the right being left open. Eserine again instilled at bedtime. There was absolutely no reaction, patient being up and about the room daily. At my visit on the 19th the strip had become so loosened that it was removed. There was no redness, and the line of corneal incision seemed perfectly healed. The pupil was round and central. No drops had been used after evening of first day. Patient was seemingly doing so well that both eyes were left open. At my visit on the 20th I was surprised to find that the corneal wound had opened for a space of about one line, and that there was a prolapse of the iris. As the hernia was of so recent occurrence, I determined to endeavor to replace it. Having let out the aqueous with a narrow cataract knife, this was readily done with the aid of a small tortoise-shell spatula, when

the pupil again became round. Eserine was continued three times a day for two more days, and patient left the hospital for his home in an adjoining county at the end of two weeks with central pupil and good vision, $\frac{20}{C}$. He has not yet returned, as promised, for final adjustment of glasses, probably because as yet the sight is still good in the right eye.

The points of special interest are:

First, that the corneal wound is not safely healed at the end of three days.

Secondly, that a recent hernia may be safely replaced instead of being clipped off as is usually done; and

Thirdly, that while it is not advisable to do so, yet a great many more liberties may be taken with eyes after cataract extraction than many of us have been taught to believe.

A CASE OF BILATERAL HEMIOPIA.

By Prof. C. SCHWEIGGER, Berlin.

Translated by Dr. Ward A. Holden, New York.

BILATERAL hemiopia is so rare that the reporting of even single observations seems called for, and I am the more persuaded to record this case, since it resembles Förster's case[1] in some particulars and in others differs from it.

H. von Sch., æt. seventy-five, had been under my treatment for several years for conjunctival catarrh and nuclear cataract of the right eye (L: Em., V = $\frac{9}{12}$; R: — 1.25, V = $\frac{6}{36}$), when in September, 1888, a hemiopic defect appeared suddenly in both left halves of the visual fields, without the occurrence of other disturbances, such as loss of consciousness, hemiparesis, etc. The central vision remained unchanged, and the ophthalmoscopic appearance was normal, as is the rule in these cases. In August, 1889, the right halves of the visual fields failed suddenly, as the left halves had failed before. The patient supposed himself to be quite blind, and his movements also gave this impression, yet, as in Förster's case, a small central field of vision was preserved. In the street he found that he still saw the dials on the clock-towers, and other distant objects, as, for example, single words in the shop-signs. A careful examination showed that at a distance of 3 or 4 metres the patient could just recognize the dial of a clock on the wall and distinguish the figures on it. Corresponding to the size of the dial (20 *cm*) and the figures, there remained a visual field of 0° 22′ at the most, in which his former acuteness of central vision was preserved. This vision was naturally useless for the perception of near objects, since a field of 22′ is much too small

[1] *v. Græfe's Arch.*, xxxvi., 1, p. 94.

for this purpose. It should be stated further that the patient had not lost the perception of light completely in the region of the hemiopic defect, since movement of the hand was perceived excentrically.

The chief point which this case presented in common with that of Förster, was the preservation of a limited central field of vision, although this was much smaller in my case than in his. This fact proves the preservation of the central acuteness of vision and the well-known inflection found in the defect in the visual field near the point of fixation, to be due to a particular arrangement in the central apparatus. The points of difference were the following:

1. In Förster's case the loss of the second halves of the fields of vision occurred gradually in the course of two days, while in my case it came suddenly.

2. The weakness of memory and the loss of the sense of locality, which Förster observed, were not found in my case. When the patient came to me, blind, except in a minimal field, he appeared familiar with the localities which he had previously known. Apart from the further development of the cataract, no change has taken place up to this time, October, 1890.

A CONTRIBUTION TO THE PATHOLOGICAL ANATOMY OF PANOPHTHALMITIS.

By Prof. JOS. SCHÖBL, Prague.

Translated by Dr. Ward A. Holden, New York.

(*With Plates X.–XV. of Vol. XXI., German Edition.*)

HAVING selected from my collection twenty-seven eyes where the clinical diagnosis of panophthalmitis from purulent choroiditis had been made, and the enucleations had been performed in various stages of the disease, I subjected them to a careful examination.

The eyes were all cut in a sagittal direction and stained for the most part with hæmatoxylin. In most cases a careful injection of the blood-vessels was made according to my method immediately after the enucleation, before the ball was put into the hardening fluid, and only a few times was this unsuccessful. Special staining for bacteria was omitted as being unreliable.

I shall first describe in brief these cases, arranging them according to the etiological factor which caused the panophthalmitis, and then draw the conclusions which naturally follow as to the pathological anatomy of panophthalmitis.

Panophthalmitis Following Various Corneal Injuries.

a.—VULNUS PERFORANS CORNEÆ CENTRALE.

Case 1 (Fig. 1).—Z., æt. fifty-six, penetrating wound through the centre of the cornea and the lens, without injury to the iris, caused by a piece of unclean iron. Progressive inflammation. Extirpation of the swollen and protruding eye in the stage of

fully developed panophthalmitis. Pus escaped through the perforated cornea.

After the successful extirpation the eye was hardened in equal parts of Müller's fluid and saturated solution of picric acid, then washed in distilled water and later in dilute alcohol, then in stronger and finally absolute alcohol, then brought in oil of cloves under the air-pump, finally imbedded in celloidin and cut in sagittal sections.

Anatomical Examination.—The eye is enlarged and pear-shaped, the sagittal diameter being 32 *mm*, the equatorial 24 *mm*. It is filled with masses of pus, no lens or vitreous can be discovered, and only a small bit of the posterior portion of the retina near the papilla remains (Fig. 1). The choroid in its whole extent is but slightly changed. The retinal pigment epithelium is preserved from the papilla to the ora serrata. Lying on the pigment layer is a layer of granulation tissue uniformly supplied with vessels which pass as short branches from the stratum vasculosum of the choroid and perforate the epithelium. This granulation tissue consists of leucocytes, scanty intervening substance, new-formed vessels, and traces of connective tissue, and is identical with the hyperplastic choroiditis described by me in vol. xix. of these ARCHIVES.

The stroma of the choroid proper is uniformly infiltrated with leucocytes. The granulation tissue is thickest on the pars plicata of the ciliary body. The iris, which is adherent to the cornea, is also covered with a thick layer of granulation tissue, having a number of new-formed vessels from the vessels of the iris.

The sclera in its outer layers contains leucocytes closely packed, and many new-formed vessels. The same exuberant granulation tissue passes in tongue-like masses into the outer layers of the sclera.

The anatomical diagnosis is therefore: retinitis purulenta; irido-cyclo-choroiditis (uveitis) hyperplastica; tenonitis hyperplastica; conjunctivitis hyperplastica.

A single glance at a preparation of this eye or at the drawing, Fig. 1, is sufficient to show that it was primarily and chiefly a retinitis purulenta, which ran its course with the clinical symptoms of a violent acute traumatic panophthalmitis, and that the uveal tract became affected later and less severely, and was in no way the occasion of the severe

clinical symptoms of panophthalmitis which were observed.

CASE 2.—E. S., æt. fourteen, centre of the cornea pierced by a small arrow, beginning cataract, yellow reflex from the fundus. Gradually there developed the characteristic picture of acute panophthalmitis with enlargement of the ball, protrusion, immobility, chemosis of the conjunctiva and lids, complete blindness, and severe pain. Extirpation two weeks after the injury.

The examination revealed conditions almost identical with those of the previous case: retinitis purulenta; irido-cyclo-choroiditis (uveitis) hyperplastica; scleritis, tenonitis; conjunctivitis hyperplastica.

In this case also there can be no doubt but that it was originally an acute traumatic retinitis which ran its course under the clinical picture of a panophthalmitis, and that the slow inflammatory changes in the choroid were of later date and lesser importance.

b.—CORPORA PEREGRINA PER CORNEAM IN BULBUM PENETRANTIA.

I have before me successful preparations of three eyes in which panophthalmitis occurred after the entrance of foreign bodies through the cornea. In all three cases fragments of gun-caps passed through the centre of the cornea and the lens into the interior of the eye, without wounding the uveal tract. These cases have been previously described in the *Centralbl. f. prakt. Augenheilk.*, March, 1889, in a paper on primary purulent retinitis.

CASE 3.—S., æt. eight, piece of gun-cap passed through cornea and lens into the vitreous. On the third day panophthalmitis incipiens, eye enucleated on the fourth day.

Microscopic Examination.—Choroid normal, retina showing signs of severe inflammation, the nerve-fibre layer greatly thickened, its vessels dilated and distended with blood, and the whole retina infiltrated with leucocytes. The hyaloid is detached from the retina and an intervening space is formed, which is filled with a thick layer of pus and masses of coagulated fibrin. The lens is displaced forward and infiltrated with leucocytes. The cornea, in

the region near the wound, the iris, and the vitreous, are also infiltrated with leucocytes.

The anatomical diagnosis is: retinitis purulenta acuta traumatica; hyalitis traumatica; phakeitis (infiltratio lentis) traumatica; irido-keratitis traumatica. No signs of choroiditis.

Case 4.—P., æt. six, fragment of gun-cap passing into the right eye through the centre of the cornea. The clinical picture and the diagnosis were similar to those of the foregoing case.

Enucleation ten days after the injury. Microscopic examination showed a dense mass of pus in the vitreous chamber, in which here and there single bits of the retina could still be distinguished.

The choroid was almost normal, but moderately thickened and slightly infiltrated with leucocytes.

In this case also there could be no doubt but that the primary and principal affection had been an acute traumatic retinitis showing the signs of beginning panophthalmitis.

Case 5.—K., æt. ten, left eye wounded in a similar manner, and a preventive enucleation made twelve days later.

The anatomical condition resembled that of Case 3, except that the anterior chamber was preserved.

Wound in cornea cicatrized. Traumatic cataract. Retina in toto greatly thickened and closely infiltrated with leucocytes, and covered on its internal surface by a thick layer of pus.

Here also the choroid was almost intact, and the disease has been undoubtedly a purulent retinitis with the symptoms of beginning panophthalmitis.

c.—COMBUSTIO CORNEÆ CUM FERRO LIQUEFACTO.

Case 6 (Fig. 2).—J., æt. twenty-seven, injured by melted iron spurting into his right eye. The iron was removed in the form of a thin plate, which had formed an accurate mould of the cornea and limbus.

Seventeen days later the patient was admitted to the hospital. The eye had been red and painful, lids swollen, V = o. At this time the eye was enlarged, prominent, and immobile. The cornea was grayish-white and vascular, there was great pain, V = o, enucleation.

The cornea was replaced by a slightly convex membranous

structure about 1 *mm* in thickness, which consisted exclusively of granulation tissue, and which, becoming thinner at its periphery, passed directly over into the iris. On the posterior surface of this structure, with which the lens lay in contact, a thin layer of iris pigment could be distinguished.

The new-formed blood-vessels of the pseudo-cornea connect peripherically with the vessels of the iris. The sclera is thickened and infiltrated with leucocytes. The lens is top-shaped and cataractous anteriorly. The retina is detached and is only recognizable in its posterior third. It is thickened and infiltrated with leucocytes.

It is evident that here the original disease was a purulent retinitis through which the anterior two thirds of the retina were disorganized, while the posterior recognizable third still shows the typical picture of purulent retinitis.

The choroid is also recognizable in its posterior third only.

It is thickened, and the thickening increases as one passes forward from the optic disc. The epithelium is preserved, chorio-capillaris and stratum vasculosum are distinguishable, and the supra-chorioidea as well; the stroma is uniformly infiltrated with leucocytes.

There existed, then, a chronic inflammatory process in the greater portion of the choroid and in the ciliary body, which consisted chiefly in the development from the normal vessels of new-formed vessels, which passed into the inflammatory products or cellular masses about the choroid.

In this case also it cannot be doubted that after the injury it was the retina which played the leading rôle in the pathological process.

d.—CONTUSIO BULBI.

Case 7 (Fig. 4).—Johann L., æt. thirty-six, struck in the right eye with the fist. On the following day the globe was swollen and injected, the vision reduced to the differentiation of light from darkness. He was admitted to the hospital on the twenty-third day.

The patient was a strong, healthy man, whose left eye was normal. The right eye had always been sound, and had good vision before the injury. The lids were now moderately swollen, the conjunctiva chemotic, the globe enlarged, prominent, and

much retarded in its movements, the cornea slightly cloudy and containing some deep blood-vessels. The anterior chamber was abolished, no trace of iris could be seen, the somewhat cloudy lens lay adherent to the posterior surface of the cornea. There was an indistinct, yellowish-white reflex from the interior of the eye, V = o. The patient complained of unbearable pain, and desired the removal of the eye.

Enucleation performed on the twenty-fifth day. The injection of the enucleated globe was only partially successful. The ball was hardened in the ordinary manner and examined. The globe was enlarged.

Microscopic Examination (Fig. 4).—The cornea is infiltrated with leucocytes and contains new-formed vessels. The episcleral tissue, the thickened sclera, and the capsule of Tenon are all infiltrated with leucocytes. The retina is recognizable in its posterior half only, and shows here the changes characteristic of purulent retinitis. Farther forward it passes over into the purulent and cellular mass which fills the entire vitreous chamber. The separate layers of the choroid can be distinguished in its posterior half only, and it is here greatly thickened and its stroma infiltrated with leucocytes. Farther forward its limits are indistinct. Large new-formed vessels, originating in the normal blood-vessels of the choroid, pass into the cellular masses which fill the vitreous chamber.

The anatomical diagnosis is, then : retinitis purulenta ; choroiditis et cyclitis carnificans (fibrosa chronica) ; luxatio lentis in cameram anteriorem ; cataracta incipiens ; keratitis interstitialis inducta ; scleritis, tenonitis.

There could be no doubt in this case also that the purulent retinitis had played the important rôle and represented the anatomical basis of the clinical picture of panophthalmitis which was observed.

Case 8.—Ch., æt. thirty, left eye severely injured by a flail, hæmophthalmus, no open wound, total blindness, intense pain. I found the conjunctiva chemotic, the globe apparently enlarged, prominent, and having but slight motility. The cornea was diffusely opaque, and showed at its margin some deep blood-vessels. Anterior chamber shallow. The iris, as far as can be told through the cloudy cornea, is dislocated, the pupil blocked

by exudative masses. The interior of the eye cannot be seen. Vision completely lost.

Enucleation on 6th day. Examination of the injected and hardened globe gave the following: Long diameter of globe 24 *mm*, transverse 23 *mm*. The cornea uniformly infiltrated with leucocytes, and having a few deep blood-vessels near its margin. The sclera and the capsule of Tenon also infiltrated with leucocytes. The retina in its posterior two thirds is clearly recognizable, shows here the same characteristics of purulent retinitis as the two cases preceding, and farther forward passes over gradually into the uniform purulent and cellular mass which fills the entire vitreous chamber.

The choroid is recognizable to the same extent as the retina, is moderately thickened and uniformly infiltrated with leucocytes.

The ciliary body is not detached, and is affected in a manner similar to the anterior portion of the choroid; small new-formed vessels pass from it through the pigment epithelium into the cellular mass. The iris is thickened and infiltrated with round cells.

e.—VULNUS CORNEÆ PERFORANS IN OCULO LÆSO.

CASE 9 (Fig. 5).—A., æt. forty-five, left eye, which had gradually become totally blind some years previously, was injured by a glass splinter a few days before his admission.

I found the bulbar conjunctiva slightly chemotic, the cornea irregularly curved and diffusely cloudy, having deep blood-vessels in places, and in the centre an obliquely running cicatrix 2½ *mm* long. The eye was somewhat exophthalmic, and could be moved but slightly. Severe pain. The eye was enucleated the following day, and injected and hardened in the usual manner.

Microscopic Examination (Fig. 5).—The globe is enlarged. The cornea is infiltrated with leucocytes, and shows deep blood-vessels, and in its central portion, cicatricial tissue. The membrane of Descemet is torn in the middle and wrinkled. The retina is considerably thickened, most markedly in the region of the optic disc, and exhibits the same pathological condition as was found in the first case with retinitis purulenta acuta traumatica. The pus cells lying on the surface of the retina are directly continuous with those which lie in the nerve-fibre layer. The optic disc is cupped. A glance at the preparation or the figure is sufficient to show that the purulent and cellular product which fills the vitre-

ous chamber was derived chiefly, if not altogether, from the retina.

This was the freshest case of retinitis purulenta traumatica which showed clinically the picture of beginning panophthalmitis that I have had an opportunity of examining.

The choroid and the ciliary body are quite normal. The iris in its whole extent is adherent to the posterior surface of the cornea, and is thickened and infiltrated with leucocytes. A number of new-formed vessels from the blood-vessels of the iris pass into the exudative masses composed of fibrin and leucocytes which fill the enlarged posterior chamber.

It would be impossible for any one to doubt that in this case it was the retinitis purulenta alone which caused the clinical picture of beginning panophthalmitis. The active participation of the vitreous in the production of the purulent and cellular masses is with almost absolute certainty excluded.

Case 10.—N., æt. twelve, thrust a thorn through the centre of his left cornea, which had an old adherent leucoma. The patient was brought to me six days after the injury. The lids were swollen and red. The conjunctiva was chemotic, the globe apparently enlarged, somewhat prominent and immobile. In the centre of the cornea was a wound 4 *mm* in diameter not wholly cicatrized, about which the cornea shows a yellowish-white infiltration. The lens was cloudy, but a yellowish reflex could still be got from the interior of the eye. The vision was entirely abolished. On the 16th day the eye was enucleated.

The cornea contained leucocytes, deep vessels, and cicatricial tissue, which, passing through the ruptured membrane of Descemet and the capsule of the lens, united with the fibres of the latter (Fig. 6). Sclera and capsule of Tenon were infiltrated with leucocytes.

There was a funnel-shaped detachment of the retina. The posterior portion of the funnel forms a solid tumor-like mass, at the periphery of which both nuclear layers of the retina can be distinguished, while the remainder consists of granulation tissue (hyperplastic retinitis).

The closely crowded and rapidly proliferating leucocytes which lay on the inner surface of the granulation masses, as well as the

budding blood-vessels found there, showed that these masses were in the stage of active growth at the time of enucleation.

There is no doubt that if the dioptric media had permitted a view into the interior of the eye, these masses would have simulated a tumor (pseudo-glioma). The vitreous chamber is filled with pus, cellular masses, and coagulated fibrin. The choroid, for the distance in which the retina it detached, is quite normal. Its anterior portion, to which the retina is still adherent, and the ciliary body are detached from the sclera, and send new-formed blood-vessels through the pigment epithelium and the pars ciliaris retinæ into the cellular masses filling the vitreous chamber.

The space between the choroid and the detached retina is filled with fibrin in whose meshes some few leucocytes are found.

Case 12.—J., æt. eighteen, was received at my clinic October 13, 1889. As a child he had suffered from recurring inflammation of the eyes, which in the left had led to partial suppuration of the cornea, perforation, and the formation of a leucoma adherens. Some months before, perhaps in June, he had struck the eye against a piece of furniture and a violent inflammation ensued leading to total blindness.

The lids of the left eye are red and swollen, the bulbar conjunctiva chemotic. The ball is enlarged, protruding, and but slightly movable. The cornea is irregularly cloudy. A yellowish-white reflex is got from the interior of the eye.

Microscopic Examination.—The iris is adherent at one point to the posterior surface of the cornea. The anatomical diagnosis is: retinitis purulenta et hyperplastica incipiens; choroiditis et cyclitis carnificans; cicatrices corneæ; keratitis inducta; synechia iridis anterior; cataracta incipiens; scleritis; tenonitis.

Case 13 (Fig. 7).—K., æt. fourteen, had suffered from infancy with continuously recurrent inflammation of the eye, which had left opacities in the cornea. The left eye was wounded with a drill. The following day the ball and the lids were swollen, the vision was nearly lost, and the patient complained of violent pain. The patient being admitted on the twelfth day I found the lids red and swollen, the bulbar conjunctiva chemotic, the globe enlarged, prominent, and immobile. The cornea irregular in its curvature, cloudy, and vascular. A clear view of the interior was not gotten, but I seemed to get a whitish reflex from the depth of the eye. Vision totally abolished. Severe pain. The other eye showed slight cloudiness of the epithelium.

Microscopic Examination.—The cornea is irregularly curved and contains leucocytes, blood-vessels, and cicatricial tissue. At its margin there is a perforation through which a portion of the lens protrudes.

Sclera and Tenon's capsule are moderately infiltrated with leucocytes.

The retina, together with the choroid and ciliary body, is detached from the sclera.

The relations of the retina are similar to those of the case preceding. The posterior portion of the detached funnel has become converted into granulation tissue, and shows leucocytes in a state of proliferation, young connective tissue, and new-formed budding blood-vessels—*i. e.*, the picture of hyperplastic inflammation, while farther forward the walls of the funnel show clearly the retinal structure. The two nuclear layers are distinguishable ; the nerve-fibre layer, where it is still distinguishable, is covered with leucocytes, and passes over into the purulent and cellular masses filling the vitreous chamber without a perceptible line of demarcation.

The choroid is nearly normal in its entire extent and lies in apposition with the retina. A number of new-formed vessels pass from the ciliary body through the pigment epithelium and the pars ciliaris retinæ into the cellular masses of the vitreous chamber.

Panophthalmitis Secundaria e Keratitide Ulcerosa.

Case 14 (Fig. 3).—N., æt. nineteen, suffered from a large osteo-sarcoma of the left shoulder. Four weeks before his admission an exophthalmus began which steadily progressed. I found the left eye prominent, dislocated outward and downward, and almost immobile. The dioptric media were clear ; the ophthalmoscope revealed a neuro-retinitis. V = $\frac{6}{6}$. Diplopia. Cerebral symptoms.

The clinical diagnosis was : sarcoma metastaticum cavi cranii et orbitæ sinistræ ; exophthalmus, neuro-retinitis oculi sinistri.

The exophthalmus and the displacement of the globe increased, and the cornea sloughed, after which panophthalmitis came on. The patient died.

The globe and the surrounding tissues were carefully injected and preserved.

Anatomical Examination.—The globe is elongated, 27 *mm* antero-posteriorly, 12 *mm* in lateral diameter, open anteriorly.

At the point of perforation the remainder of the cornea has united with the iris and formed a small spherical granuloma.

The detached retina is only recognizable in its posterior third. It is densely infiltrated with leucocytes and anteriorly it passes imperceptibly into the purulent masses which fill the whole interior of the ball.

The choroid and the ciliary body are detached from the sclera in most of their extent, and the suprachoroidal space is filled with pus, cellular masses, and coagulated fibrin. The chorio-capillaris is well preserved throughout, the stratum vasculosum is for the most part transformed into a purulent mass. The sclera is infiltrated with leucocytes, and considerably folded. About it, corresponding to the position of Tenon's capsule, are quantities of leucocytes and young connective tissue.

The ball is surrounded anteriorly by large hypertrophic folds, which correspond in position to the bulbar conjunctiva, the fornix, and in part the palpebral conjunctiva. These folds are covered with thickened epithelium, and consist of new connective tissue, new-formed blood-vessels, and leucocytes. We must consider these as being products of a hyperplastic inflammation of the conjunctiva. Upward and inward from the ball, sarcomatous masses are found.

We shall not be in error, if we assume that in this case retinitis and choroiditis purulenta developed simultaneously, and that both were factors in the production of the clinical picture of panophthalmitis. The presence of chemosis or conjunctivitis hyperplastica in this case seems to me noteworthy.

Atrophia Bulbi Progrescens e Panophthalmitide.

I shall mention but briefly several cases in which enucleation was performed after a panophthalmitis had run its course.

Case 15.—J. R., æt. six, had suffered from frequently recurring inflammation of both eyes (kerato-conjunctivitis phlyctenulosa). April 1, 1876, one of these pustular phlyctenulæ led to a purulent infiltration and perforation of a considerable portion of the cornea, and a secondary panophthalmitis ensued, with enlargement, protrusion, and immobility of the globe, marked chemosis of the lids and conjunctiva, complete loss of vision and severe

pain. A thick pus was poured out from time to time through the corneal perforation. The inflammatory symptoms decreased later.

The examination gave as the anatomical diagnosis: Retinitis purulenta; choroiditis purulenta et hyperplastica; iritis hyperplastica; scleritis, tenonitis.

In this case also it is probable that the pus filling the interior of the globe came from the retina, while that in the suprachoroidal space came from the stratum vasculosum of the choroid.

The three following cases correspond to that just reported in the most important particulars, both as to the clinical course and the anatomical changes found, and I shall therefore state them briefly:

CASE 16.—J., æt. three, living in bad hygienic conditions in a damp cellar, suffered from kerato-conjunctivitis phlyctenulosa, which finally led to infiltration and perforation of the left cornea, and later to a secondary panophthalmitis. The eye was enucleated. The anatomical changes were nearly identical with those in the preceding case.

CASE 17.—F., æt. four, was brought to my clinic with a broad marginal phlyctenula. The general condition was bad. The eye perforated and secondary panophthalmitis developed. The anatomical changes in the eye, enucleated after death, were similar to those in the preceding case.

CASE 18.—K., æt. two, suffered from xerosis conjunctivæ infantilis, and his general condition was bad. Xerosis corneæ followed, then exfoliation, secondary panophthalmitis, and finally death. The anatomical changes here were similar to those in the preceding cases.

Panophthalmitis Metastatica.

I had at one time some sixteen cases of panophthalmitis metastatica, collected in the days before antiseptics were introduced into the maternity hospitals, when puerperal diseases were common, but these preparations have been taken surreptitiously from my collection, and I shall therefore only report briefly two recent cases from my clinic.

CASE 19.—B., æt. forty-five, was admitted to my clinic eleven weeks after childbirth. The formerly enlarged eyeball was then

small and but slightly movable, the conjunctiva somewhat chemotic, a yellowish-white reflex was obtained from the interior of the eye, the vision was entirely lost. Perforation of the sclera followed and further shrinking of the ball.

Microscopic Examination.—The sclera is thickened, folded in places, and infiltrated with leucocytes. The capsule of Tenon is likewise infiltrated. Retina and choroid are uniformly thickened and show tumor-like masses which consist of young connective tissue, new-formed vessels, and leucocytes. The small vitreous chamber which remains is filled with an exudative mass, which contains new-formed vessels, and which is in the process of becoming connective tissue. The iris is but slightly changed, showing some leucocytes. There are small masses of fibrin in the anterior chamber. The lens shows beginning cataract formation.

The question whether in this case the process developed originally from the retina or from the choroid is hard to decide, since the changes in the two membranes are so equally advanced.

Case 20.—B., æt. twenty-four, was brought to my clinic Dec. 21, 1888, in a moribund condition without any history.

The eyes were moderately prominent and immobile, the conjunctiva chemotic, the interior of the eyes giving a yellowish reflex.

Diagnosis: choroiditis purulenta metastatica oculi utriusque.

The patient died some days later and the eyes were enucleated after death. I have preserved one, and given one to my assistant.

Anatomical Examination.—The globe is but slightly enlarged and of normal shape. The retina shows in its posterior portion the signs of retinitis purulenta, and its inner surface is covered with a thick layer of pus continuous with the leucocytes crowding the nerve-fibre layer, that are thickest about the vessels.

The choroid in its posterior portion, where the retinal affection is most marked, is thickened and infiltrated with leucocytes. Elsewhere it is normal, as are the ciliary body, iris, lens, and cornea.

Panophthalmitis after Various Injuries per Scleram.

Case 21 (Fig. 8).—S., æt. forty-five, splinter of iron flew into the right eye. Two days later he was admitted to my clinic. I

found the right lids red and swollen, the bulbar conjunctiva chemotic, the eyeball enlarged, exophthalmic, immobile, and in the sclera 5 *mm* outward from the corneal margin, a wound 2½ *mm* in diameter.

The cornea was steamy and the aqueous humor cloudy. The iris was discolored, the reflex from the interior of the eye intensely yellowish-white. Vision was abolished. Severe pain. The eye was enucleated on the fifth day.

Anatomical Examination.—Globe enlarged (Fig. 9), of obliquely oval form, long diameter 25 *mm*, transverse 27 *mm*. Cornea, sclera, and capsule of Tenon richly infiltrated with leucocytes. In the pars plana of the ciliary body there is a perforation through which pus exudes. The choroid is greatly thickened, and shows in its posterior portion, at the temporal side, large papillary excrescences. The choroid is infiltrated with pus and leucocytes in its whole extent, but most markedly just about the blood-vessels.

The retina has been entirely destroyed by suppuration. The foreign body, a splinter of iron 4 *mm* by 2 *mm*, lay in the purulent mass on the floor of the vitreous chamber.

This case was one of true fulminating choroiditis purulenta. It cannot be stated with certainty in what manner and when the retina was associated in the inflammatory process, but this probably occurred secondarily.

Case 22.—K., æt. sixty, a fragment of stone passed through the ciliary region into the interior of the eye. A typical case of panophthalmitis developed. Fifteen days later, when the violent symptoms had abated and the ball had again become movable, it was enucleated. The microscopic examination showed choroiditis purulenta and secondary retinitis purulenta.

Case 23.—N., æt. thirteen, stuck the blade of a penknife deep into the eye in the ciliary region. The typical picture of panophthalmitis followed. Enucleation four weeks later. The microscopic examination showed choroiditis purulenta and secondary retinitis purulenta.

Case 24.—K., æt. thirty-four, was stuck in the ciliary region by a fragment of a pot. The eye became blind and showed a cicatricial staphyloma of the cornea. Typical panophthalmitis followed. Enucleation ten days after the injury. The microscopic

examination showed choroiditis purulenta. The entire retina had suppurated.

CASE 25.—P., æt. thirty-one, a splinter of iron, perforating the cornea, penetrated into the ciliary body, causing a typical case of panophthalmitis. The eye was enucleated, and the microscopic examination showed choroiditis purulenta with secondary involvement of the retina.

Recapitulation and Remarks.

Retinitis purulenta as the primary and chief lesion of the panophthalmitis was found in 10 cases, namely, in 2 of perforating wounds of the cornea (1, 2), in 3 of foreign bodies which had entered the eye through the cornea (3, 4, 5), in 1 of total burning of the cornea from melted iron (6), in 2 of severe contusion of the eye (7, 8), in 2 of injuries of the cornea in eyes previously diseased (9, 10).

Retinitis purulenta followed by retinitis hyperplastica was found in 3 cases (11, 12, 13).

Retinitis and choroiditis purulenta, in all probability coming on simultaneously, formed the anatomical basis of the panophthalmitis in 5 cases (14–18).

Retinitis purulenta was the lesion found in 2 cases of metastatic panophthalmitis after labor (19, 20).

Choroiditis purulenta was found in 3 cases in which foreign bodies had passed through the sclera in the ciliary region (21, 22, 25).

Choroiditis purulenta was found in two cases in which there had been penetrating wounds in the ciliary region (23, 24).

Leaving out of account the one case of metastatic panophthalmitis in which the primary disease could not be ascertained, there remain 24 cases of panophthalmitis, the anatomical examination of which showed the lesion to be undoubtedly retinitis purulenta in 11 cases (1–10, 20), probably retinitis purulenta in 3 cases (11, 12, 13), probably retinitis and choroiditis purulenta simultaneously in 5 cases (14–18), and a genuine choroiditis purulenta in 5 cases (21–25).

This shows that the clinical picture of panophthalmitis should not be assumed to depend always on a choroiditis

purulenta, as is done in all text-books and other works and treatises on this disease, but that the clinical picture of typical panophthalmitis depends far more frequently on a retinitis purulenta than on a choroiditis purulenta.

Besides this principal conclusion which I have drawn from my studies, I would offer some others, although my material is too small to warrant me in considering these conclusions more than probabilities.

In every case in which a foreign body passed through the centre of the cornea into the interior of the eye, without wounding the uveal tract, the panophthalmitis which developed depended on a retinitis purulenta. This is also true of the cases of central perforating wounds of the cornea, of burning of the cornea, and of contusion of the ball where the blunt force reached the cornea from before.

In all cases of panophthalmitis secondaria inducta it is very probable that both retina and choroid were affected equally and at the same time by the purulent inflammation.

From this I would conclude that in secondary panophthalmitis caused by total suppuration of the cornea, whether after blennorrhœa, xerosis of the cornea, or severe phlyc. tenulæ, these two membranes are attacked by purulent inflammation at the same time, or one shortly after the other, and the lesion producing the symptoms of the panophthalmitis is in all probability a simultaneous retinitis and choroiditis purulenta.

Based upon the communications of Virchow (*Virchow's Archiv*, vol. ix., p. 307, and vol. x., p. 175), Nagel (*Græfe's Archiv*, vol. vi., 1, p. 219), Heiberg (*Med. Centralblatt*, No. 36, 1874), Oeller (*Archiv für Augenheilkunde*, vol. viii., p. 357), Hirschberg (the same *Archiv*, vol. ix., p. 299), and upon my own cases, I believe myself justified in drawing the probable conclusion that in *panophthalmitis metastatica*, the lesion is at times retinitis purulenta, at others choroiditis purulenta, finally perhaps both together.

In all my cases in which a foreign body passed through cornea and sclera into the interior of the eye with marked injury to the uveal tract, or where there were severe penetrating wounds in the ciliary region or farther back, choroi-

ditis purulenta was found as the anatomical basis of the panophthalmitis.

A further result of my studies is the proof that so-called carnificating and hyperplastic inflammations almost invariably play an important part in the panophthalmitic process.

Choroiditis, cyclitis, iritis or retinitis carnificans seu chronica fibrosa is the process in which, from the normal vessels of these parts, numerous new-formed vessels develop, which run into the surrounding inflammatory products, which consist of cells and intervening substance.

In this way the exudative masses are organized, becoming young connective tissue, from which later cicatricial tissue may develop.

It is a process analogous to that in the lung, which has been described as pneumonia carnificans seu chronica fibrosa.

Choroiditis, cyclitis, iritis, retinitis, scleritis, conjunctivitis, tenonitis, etc., hyperplastica, on the contrary, is the process in which, through the exudation, proliferation, and further development of leucocytes, and through the development of new-formed blood-vessels in the part itself, there is formed an actual granulation tissue, and thus gradually a more or less marked hyperplasia of the part. These cells then develop into connective-tissue cells and may finally form cicatricial tissue.

In the first case there is an organization of exudative masses which lie on the part, in the second case there is a true hyperplastic thickening of the part itself.

Supplementary.

After this paper was concluded, I found by accident two eyeballs in my collection which had exhibited the clinical picture of panophthalmitis before their enucleation. Both of these eyes were enucleated at a late stage, when the panophthalmitis had nearly run its course, and since they are of interest as completing our picture of this pathological process, I shall describe them briefly.

Case 26 (Fig. 9).—J., æt. twenty-six, was severely injured in the right eye by a bit of unslaked lime. The eye and lids

swelled and were very painful. Sight abolished. Six days later I found a fulminating panophthalmitis. Three weeks later patient appeared again with beginning atrophy of the ball. The patient consented four weeks later to have the eye enucleated.

Anatomical Examination.—The cornea is replaced by a tumor-like mass, springing from the anterior portion of the uveal tract, consisting of granulation tissue covered with irregular epithelium, and containing leucocytes, young connective tissue, and a number of new-formed vessels.

The choroid is detached on the temporal side as far forward as the æquator of the eye, and completely detached on the nasal side together with the ciliary body. The entire choroid is degenerated into a thick layer of granulation tissue, consisting of leucocytes, young connective tissue, and new-formed blood-vessels, which is continuous on the temporal side with the tumor-like granulation tissue replacing the cornea.

We see in this case, as in none of the foregoing, how the new-formed blood-vessels from the detached choroid develop in two directions, inward and outward.

Case 27.—D., æt. twenty-six. A fragment of steel about ten *mm* in diameter pierced his left upper lid and remained fast in the cornea and sclera. Removed, it left a wound ten *mm* long, which extended from the centre of the cornea downward and inward through the ciliary region into the sclera. The anterior chamber and the conjunctival sac contained blood. The vision was abolished, and the patient complained of severe pain. In a week the typical picture of fulminating panophthalmitis developed. Two weeks later I removed the shrinking globe.

Anatomical Examination.—The cornea is replaced by a large fungus-shaped mass of granulation tissue and young connective tissue springing from the uveal tract. The conjunctiva is irregularly thickened and contained leucocytes, young connective tissue, and new-formed blood-vessels. The sclera is thickened and infiltrated with leucocytes, as is the capsule of Tenon. Retina and choroid, recognizable in their posterior portion only, pass over, farther forward, into the general granulation tissue.

If we take now a general oversight of the entire panophthalmitic process, we find that, whether the disease be of traumatic, secondary, or metastatic origin, it com-

mences constantly with a fulminating purulent retinitis or choroiditis, or with both together. To this is soon added a scleritis and tenonitis, and, if the cornea has not been previously destroyed, a keratitis inducta interstitialis follows, which may assume a suppurative character later. Following this come the carnificating and hyperplastic inflammations of the various parts of the globe, particularly of the uvea. In general the carnificating processes precede the hyperplastic, so that the original purulent masses are gradually replaced by granulation tissue, from which later young connective tissue develops, filling at last the whole interior of the globe. Finally the new-formed connective-tissue masses may undergo a cicatricial shrinking, and retrograde metamorphoses take place.

EXPLANATION OF THE FIGURES.

Fig 1 shows a longitudinal section of the eye of Case 1, enucleated for panophthalmitis after a central penetrating wound of the cornea. The pear-shaped globe, open anteriorly, is filled with pus. The remaining portion of the retina exhibits the picture of purulent retinitis; the entire uveal tract, that of hyperplastic inflammation in the first stages.

The tongue-formed prolongations growing from the capsule of Tenon into the sclera are to be considered as a tenonitis hyperplastica.

Fig. 2 represents a longitudinal section of the eye of Case 6, with panophthalmitis after combustion of the cornea with melted iron. Anteriorly we see a membrane composed of granulation tissue replacing the cornea, which is to be considered as a product of iritis hyperplastica. The vitreous chamber is filled with pus and cellular masses. The retina, only recognizable in its posterior portion, shows the picture of purulent retinitis; choroid and ciliary body show the picture of carnificating inflammation.

Fig. 3 represents a section of the eye in Case 14, of secondary panophthalmitis in consequence of xerotic suppuration of the cornea. The globe, open anteriorly and stretched in an anteroposterior direction, is surrounded by folds of hyperplastic conjunctiva (conjunctivitis hyperplastica), and its interior is filled with pus. Retina and choroid show the picture of purulent inflammation.

Fig. 4 shows a section of the eye in Case 6, having panophthalmitis in consequence of contusion of the ball. The lens, escaped from its capsule, is luxated into the anterior chamber, the iris being drawn together behind it; the periphery of the vitreous is filled with pus and cellular masses. Retinitis purulenta; choroiditis and cyclitis carnificans; keratitis inducta; scleritis, tenonitis, and cataracta incipiens.

Fig. 5 represents a section of the eye in Case 9, of beginning panophthalmitis after perforating corneal wound in a weak-sighted eye. It shows the characteristic picture of retinitis purulenta and iritis carnificans. The iris lies in apposition with the cornea; choroid and ciliary body are almost normal; the cornea contains leucocytes, cicatricial tissue, and deep blood-vessels.

Fig. 6 represents a section of the eye in Case 11, of panophthalmitis after injury of the previously diseased eye. The lens is adherent to the cornea; synechia lentis; the posterior half of the retina is detached. Retinitis hyperplastica; choroiditis and cyclitis carnificans; amotio corporis ciliaris; cicatrices corneæ; keratitis inducta; cataracta incipiens.

Fig. 7 shows a section of the eye in Case 13; also panophthalmits after a penetrating corneal wound in an eye previously diseased. Prolapse of the lens, phacocele. Retina and choroid detached. Retinitis hyperplastica; cyclitis carnificans; cicatrices corneæ; keratitis inducta; cataracta incipiens.

Fig 8 shows a section of the eye in Case 21, of fulminating panophthalmitis after the passage of a splinter of iron through the sclera into the vitreous chamber. The sclera on the left side ruptured and wrinkled, the entire vitreous chamber filled with pus. The choroid shows the typical picture of a purulent choroiditis; no trace of the retina can be seen. Keratitis inducta, scleritis, tenonitis.

Fig. 9 represents a section of the eye in Case 26, with beginning progressive atrophy after panophthalmitis in consequence of burning with unslaked lime. Uveitis totalis hyperplastica with simultaneous choroiditis carnificans. Retinitis hyperplastica, scleritis, tenonitis. In the centre of the globe a small localized collection of pus.

INSUFFICIENCY OF THE OBLIQUE MUSCLES.

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(*With five drawings.*)

EVERY ophthalmic surgeon, however skilled in correcting errors of refraction and in operating for the different known forms of heterophoria, has had cases of eye-strain for which he could do but little. In investigating a few such cases during the last six months I have found the cause to be a want of equilibrium on the part of the *oblique muscles*. The detection of this condition is easy. I place a double prism (my modification of the Maddox prism) before one eye, the other for the moment being covered, and ask the patient to look at a horizontal line on a card held eighteen inches away. The effect of the double prism (each 6°, bases in), so placed that the axis is vertical, is to make the line appear to be two, each parallel with the other. The other eye is now uncovered, and a third line is seen between the other two, with which it should be perfectly parallel.

While a change of the position of the axis of the double prism from the vertical towards the horizontal will alter the distance between the lines, their direction will be unchanged, hence no loss of parallelism. This fact admits of a little carelessness in the placing of the prism in the trial-frames, though the axis should be vertical so as to give the maximum distance between the two extreme lines.

If there is a want of harmony on the part of the oblique muscles this test will show it at once in a want of parallel-

ism of the middle with the two other lines, the right end of the middle line pointing towards the bottom and the left end towards the top line, or *vice versa*, depending on the nature of the individual case.

Fig. 1.

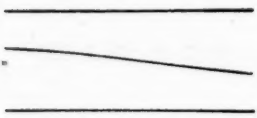


Fig. 3.

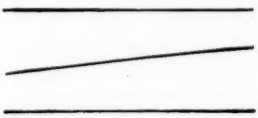


Fig. 2.

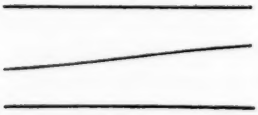


Fig 4.

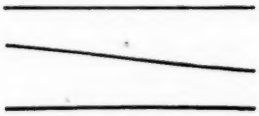
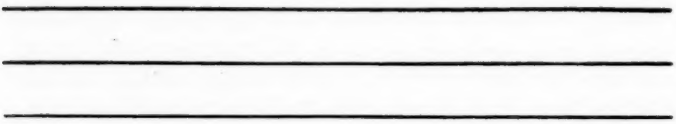


Fig. 5.



In my investigations I have always considered the eye before which no prism is held as the one under test. With the double prism before the right eye the patient is asked about the position and direction of the middle line. It may be nearer the bottom, thus showing left hyperphoria; or, again, it may extend farther to the right than the other two and not so far to the left, thus showing exophoria, or *vice versa*, showing esophoria. If the right ends of the middle and bottom lines converge while the left ends diverge, the superior oblique of the left eye is at once shown to be in a state of underaction. Fig. 1 represents such a test of the left eye. Fig. 2 shows a test of the left eye when the inferior oblique is the too weak muscle. Fig. 3 represents a test of the

right eye, the loss of parallelism between the lines being due to underaction of its superior oblique, and Fig. 4 the same condition of the inferior oblique of the right eye. Fig. 5 represents a test of both eyes when there is perfect equilibrium of the oblique muscles.

As is well known, the function of the oblique muscles is to keep the naturally vertical meridians of the two corneæ parallel even when not vertical. This must be, or a troublesome form of double vision will result. If there is perfect equilibrium of the obliques, this parallelism of the meridians named is maintained without trouble; but if the superior oblique of either eye be too strong for its inferior, or *vice versa*, the parallelism of the vertical meridians is preserved, and double vision prevented only by excessive work on the part of the weaker muscle. This condition of the oblique muscles brings on, at longer or shorter intervals, a train of nervous symptoms for which, at present, I can see no hope of prevention or cure.

A CASE OF CONGENITAL DISPLACEMENT OF BOTH PUPILS.

By W. E. BAXTER, M.D., Bangor, Me.

Mr. M., American, aged fifty-two, consulted me August 8, 1890, complaining of severe pain in the eyes. He states that he has always been "near-sighted," and that people have frequently told him that his eyes were *queer*.

Three years ago, while cutting wood, he was struck on the left eye with a splinter. The eye and lid became very much inflamed, but in a week or ten days this passed away. He then noticed that he could not see as well as before. One year after this he was struck in the same way in the right eye, but this did not seem to cause him any trouble. For the last month pain has been very severe, starting in the left eye, and now also affecting the right eye. He had no pain until a month ago.

On examination the following condition was found: V O D $\frac{1}{60}$, with $+$ 10 D $\frac{5}{60}$. V O S, fingers at .5 *m*. No improvement with glasses. Right eye, T_n; left, $+T_1$. Pupils of both eyes displaced to the upper and outer edge of the cornea. Irides blue, right *very tremulous*, left muddy; in the left anterior chamber the small dark lens is visible; the irides forming a curtain as it were with only a small opening at upper part, through which the red reflex is seen, but no vessels or edge of the lens in the right eye.

No treatment was attempted, as the patient refused the proposed removal of the dislocated lens, with an iridectomy for optical purposes.

THE PERFECTED PRISMOMETER: ITS PRACTICAL ADVANTAGES, CONSTRUCTION, AND VARIOUS APPLICATIONS.

By CHAS. F. PRENTICE, New York.

(With ten woodcuts.)

IN the first numbers of these ARCHIVES of the year 1890, I described "A Metric System of Numbering and Measuring Prisms," which represented the result of a careful and extensive study of the subject, due to the suggestion of Dr. S. M. Burnett, who had entrusted me with the problem of searching for a system which should prove satisfactory to ophthalmologists as well as avoid conflict with the practical methods of manufacturing opticians. At the close of my investigations I felt that this had not only been accomplished, but that also an instrument in support of that system had been offered as a valuable assistant to opticians.

My familiarity with the routine of manufacture would not allow me to lose sight of the practical side, so that this, being a matter of primary importance to opticians, was kept well in view from the outset. In advocating the metric system and the use of the prismometer, I shall therefore here only do so in so far as they relate to the interests of manufacturing and dispensing opticians; the advantages of the system to ophthalmic practice having been previously set forth.

My argument in favor of the metric system **was** and **is** based upon the **unavoidable variability in the angles of our prisms,** and which must result from the present process of manufacture. Although this has been indicated in the

previous papers,[1] I shall here take the liberty of quoting from a paper read in connection with my exhibit of the prismometer before the New York Academy of Medicine, October 20, 1890:

"It would, however, be exceedingly difficult and correspondingly expensive to manufacture prisms producing only fixed intervals of deflection. To render prisms sufficiently inexpensive as spectacle glasses it is necessary that they should be produced in large quantities at one grinding."

"The process at present consists in fastening a number of slabs of glass, by means of pitch, or other resinous material, upon a metallic surface-tool. The friction in grinding generates more or less heat, which at times is sufficient to soften the pitch and cause it to yield beneath the slabs. Some slabs will shift more than others, so that the prism-angles will vary more or less throughout. Besides, the underlying layer of pitch can never be of a uniform thickness." Were it not for these facts, I believe competition alone would long ere this have resulted in greater uniformity.

By means of the prismometer I found prisms, more especially of low degree, to vary between ten per cent. and thirty per cent. of their indicated numbering.

It is obvious that if manufacturers were obliged to discard all those prisms which varied from desired fixed intervals of prism-angle, **minimum** deviation, or any other designated deflection, the price would have to be increased on the perfect prisms sufficiently to compensate for the cost of those rejected, and which would have consumed equally as much material, time, and labor to produce.

Without confining myself to the deflections which should, by calculation, correspond to the prism-angles and index, I found, by means of the prismometer, among a series of prisms, of best Parisian manufacture, only the following number to produce deflections which were *even* alike:

Three doz. prisms	1°	2°	3°	4°	5°	
Number alike	6 = 1.1	7 = 2	6 = 3.1	6 = 3.7	8 = 4.6	prism-dioptries
Balance varying between	0.8 & 1.6	1.8 & 2.5	2.6 & 3.2	3.4 & 3.9	4.4 & 4.8	" "

[1] ARCHIVES OF OPHTH., xix., Nos. 1 and 2, 1890.

These prisms were taken from original papers, and may be credited with having been made of the same material, at the same time, and upon the same tools. Greater precaution on the part of the manufacturer could not be expected.

To the *careful* reader of my papers it must have been apparent that **stress** had **nowhere** been laid upon the possibility of a variability in the index, but, on the contrary, that all my deductions were referred to the commonly accepted index of 1.53.

The privileges, however, were mentioned[1] which manufacturers might avail themselves of, both in respect to prism-angle and index, in seeking to provide prisms of the desired properties.

To any one familiar with the use of optical theodolites[2] and spectrometers[3] it must further be apparent that an endeavor to measure the *minimum* deviation, with prisms of small angles especially, is very tedious and difficult. The apparatus is expensive, requires a degree of accuracy in manipulation, and a knowledge in the reading of verniers, with which opticians can not readily be made familiar. To mount such prisms accurately upon the table of the spectrometer, and rectify the various adjustments of the instrument, are tiresome and slow operations which alone are sufficient to condemn its daily use by opticians whose work must necessarily be expeditious. In the physical laboratory, however, the instrument is undoubtedly invaluable. If the use of an instrument is to be abandoned for measurement of the minimum deviation, we shall find that manufacturers will simply divide the prism-angles by two (2), for the new nomenclature, and so give us the old culprit disguised under a new name. There would be great commercial convenience to be sure, in being able to dispose of the same prism under two names, but no *reform* in the interest of scientific exactness could be effected *without* measurement. Will it be policy under such circumstances to adhere to the *minimum*

[1] ARCHIVES OF OPHTH., xix., No. 1, p. 67, 1890.
[2] *Lehrbuch der Physik.*, Prof. Joh. Müller, Braunschweig, 1878.
[3] "Practical Physics," Glazebrook & Shaw, London, 1889.
"Elements of Physical Manipulation," Prof. Ed. C. Pickering, Boston, 1873.

deviation merely for principle's sake? As the prismometer is intended to measure the refraction of prisms, in terms of the prism-dioptry, it may be well, for the benefit of those who may have found its **simplicity** obscured by the mathematical portion of my papers, again to explain its principles in more simple and somewhat different terms.

We know that a lens-dioptry is the unit of refraction, and corresponds to a lens of one meter focus, Fig. 1.

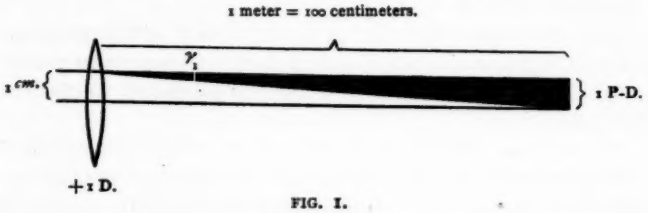


FIG. 1.

The prism-dioptry, *since lenses are but a fusion of prisms of varying angle*, may then be said to be the **linear deflection** which the refracted ray sustains **at the focus of a meter-lens,** when the incident ray impinges upon a peripheral portion of the lens **one centimeter** from the optical centre (Fig. 1).

The prism-dioptry therefore also represents the measure of the angle of deviation γ_1, for an eccentricity or decentration of one centimeter (Fig. 1).

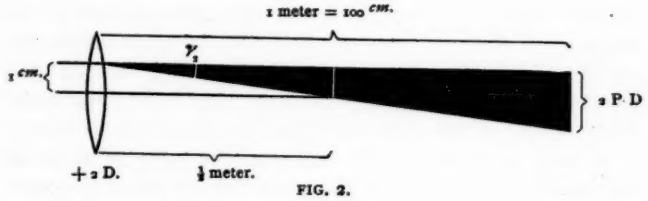


FIG. 2.

A ray impinging upon the same point of a 2-dioptry lens (Fig. 2) will sustain the *same unit* deflection at its focus ½ meter, and will therefore find the measure of its angle of deviation γ_2, expressed by twice the deflection at the meter-plane, or 2 prism-dioptries. A lens being decentred

twice or half as much will produce twice or half as many prism-dioptries as the lens possesses lenticular dioptries of refraction.[1] The prism-dioptry is therefore but a sequence to the lens-dioptry. Nothing can be more simple. Thus the prism-dioptry represents the proportion 1:100, which is expressive of a grade of angular inclination in **daily use** by engineers and scientists the world over. To reduce prism-dioptries to degrees of angular deviation, it is only necessary to divide the prism-dioptries by 100, when they will represent the tangents to correlative angles in degrees, which are to be readily found in any table of sines and tangents. Since different lenses, through varying decentration, will produce different values of the angles of deviation $\gamma_1\gamma_2 \ldots$, how will it be possible to determine the value of such angles in degrees, minutes, and seconds? The instrument is yet to be invented. The prism-dioptry and the prismometer solve the problem, and in a manner simple and rapid enough to any one of ordinary intelligence.

Since the therapeutic value of prisms is conceded, and their combination with lenses in practice frequent, the prismometer has been constructed with due regard to such combinations, making it possible by its aid to utilize to advantage the prismatic action due to decentration of the lens, for the purpose of offsetting the error which *invariably* exists in the constant prism, after the combination has been ground. Would it not then seem unwise and even arbitrary to hamper the dispensing optician in the practical fulfilment of his work by forcing him to a system of degrees, merely because it harmonizes with the designation of a strabismus which is incorrigible by prisms, or with the graduations found upon perimeters, ophthalmometers, etc., which have no connection with prisms whatever?

The metric system certainly possesses the commendation of reducing all the glasses of the trial case to a uniform nomenclature in dioptries. This alone should be considered a *practical* advantage, fully offsetting the merits of an *unverified theoretical minimum* deviation.

[1] "A Metric System of Numbering and Measuring Prisms," ARCHIVES OF OPHTH., xix., Nos. 2 and 3, 1890.

If I may be permitted to offer a suggestion, let us learn to comprehend the power of our prisms by the limits of refraction, shown by the solid triangles in the preceding figures, when it will become wonderfully easy to fit these into meter-angles, or for that matter to any other angles in space, without necessarily confounding prism-dioptries with meter-angles, or meter-angles with "deviations of the eyes in height," as stated by Dr. Landolt.[1] The latter mistake could only be the result of a misconception of the definitions of the prism-dioptry and its relations to the meter-angle.

In recommending the metric system to the profession and practical opticians, I in conclusion beg to call attention to its superior advantages, as follows:

1. From a mechanical point of view, by taking the unavoidable difficulties of manufacture into consideration.

2. From a commercial and pecuniary point of view, by avoiding unnecessary expense in the production of prisms.

3. By the prismometer, which enables opticians to accurately fill the demands of the system.

Any system which neglects these important considerations *cannot* be considered progressive, nor can it effect a *reform* in the present necessarily haphazard endeavors of the dispensing optician, with whom so much of the blame and responsibility must rest. Opticians have always been on the alert to meet the requirements of the profession, and will no doubt gladly avail themselves of a system and an instrument which will enable them to sustain their reputations as mechanicians.

Taking all the facts into consideration, it suffices to say, that we have prisms of almost every imaginable deflection on hand in the market to-day, so that it merely requires an instrument of simple construction, which may be used in making the proper selection with **accuracy** and **despatch**, and this is precisely what is claimed for the prismometer, which it is my purpose here to describe.

In the accompanying illustration, Fig. 3, the essential operative parts of the instrument are shown as being mounted upon a tri-

[1] "On the Numbering of Prismatic Glasses," ARCHIVES OF OPHTH., xix., No. 4, 1890.

angular truss which is pivoted by a suitable joint to a pedestal, so as to permit of convenient inclination of the whole.

The graduated bar is rigidly supported near its extremities, upon the truss, by two short studs or pillars, the latter being slightly higher than the radius of the circular stage, which is supported at its back by a rod, fitted, sliding, and acted upon by a spring within the bar, so as to automatically effect contact of the face of the stage with the knife-edge, which is also mounted upon the truss, between the stage and the pinhole eye-piece.

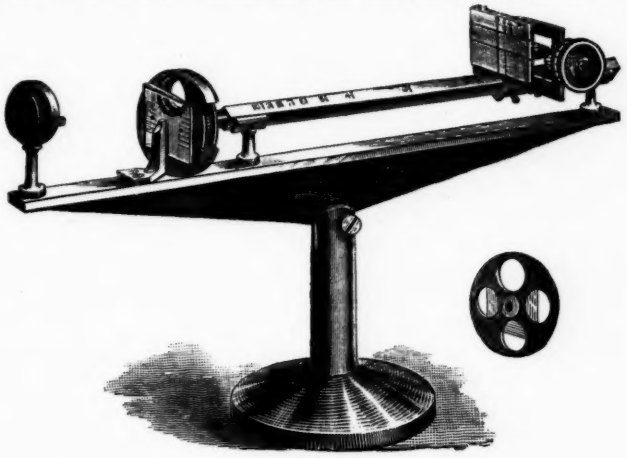


FIG. 3.

The divisions of the graduated bar, numbered 2, 3, 4 up to 10, are placed at $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, up to $\frac{1}{10}$ of the meter[1] length, counted from the knife-edge, which represents the zero-end of the scale. A plane, perpendicular and arranged to slide upon the graduated bar, termed the index-plate, is provided with the index-line, marked zero (0), and two graduations at the right-hand upper edge, marked 1 and 2, which, being equal to correlative centimeter deflections at the meter-plane, correspond to their equivalents in prism-dioptries.

To facilitate subdivision of these graduations the index-plate is provided with a transverse slide, bearing its allotted part of the index-line, which is rendered adjustable by a milled head and

[1] It has been found convenient to construct the instrument to half scale throughout.

micrometer screw, the first complete rotation of which will cause this section of the index-line to travel from 0 to 1, the second complete rotation taking it from 1 to 2. The milled head, being divided into 100 parts, enables us, by its graduations, to determine the position of the index-line of the transverse slide, relatively to the graduations upon the face of the index-plate, in 10ths and 100ths.

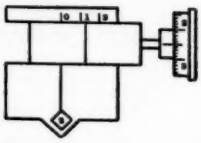


FIG. 4.

Thus, in the accompanying figure (4) we read from the face of the index-plate "1" and from the milled head $\frac{2}{10}$ths and $\frac{5}{100}$ths or 1.25 for the position of the index-line of the transverse slide.

As all readings of deflection must be reduced to the *meter-plane*, it will be necessary to note the position of the index-plate, *which must at all times correspond to one of the graduations of the bar*. Consequently, if the above reading is taken from the index-plate, when placed at the figure "2" of the bar, we shall have twice the number of prism-dioptries at the meter-plane, or $1.25 \times 2 = 2.5$ P-D.

For a reading of "2," from the index-plate, when placed at the graduation upon the bar marked "10," we have 20 P-D, which is the maximum measuring capacity of the instrument. In other words, it is merely necessary to *multiply* the readings of the index-plate by that figure upon the bar which defines the position of the index-plate upon it.

Before placing a prism in position for measurement, it is necessary to carefully determine its *passive* or non-refracting plane. This is accomplished by such slight rotary adjustment of it before the eye, until a line, situated at a convenient distance, is sighted as an unbroken one, being precisely the same method which we employ in determining the axes of cylinders. For convenience of registration, ink dots, in collimation with said line, should be applied to the prism. The stage is provided with a series of horizontal lines, engraved upon it, to facilitate perfect adjustment of the base-apex line of the prism, which is to be introduced between the stage and the knife-edge, with its apex to

the right, and gradually forced downward while the ink dots pass successively from one horizontal line of the stage to the other, until the upper edge of the prism exactly bisects the circular opening in the stage. In this position the prism will exactly cover the lower half of the opening, while its lateral upper edge will be in collimation with the lower edge of the transverse slide. On completion of this adjustment it is of the utmost importance that the ink dots should coincide with one of the parallel lines of the stage. The observer's eye being placed before the eye-piece, will now perceive the upper edge of the index-plate, and the index-line at zero of the transverse slide, in their true positions, whereas the lower portion of the index-plate, with its index-line, being seen through the prism below, will appear displaced to the right. The position of the observer's eye is now to be carefully maintained, while the graduated milled head is operated with the right hand, until the index-line of the transverse slide has been shifted sufficiently to the right to make contact with the lower index-line seen through the prism. Perfect coincidence of these lines is necessary for an accurate determination of the deflecting power of the prism at any distance. It will consequently be well to previously remove any roughness of the upper base-apex edge of the prism by grinding it to a flat dull edge, and, to be very precise, to take the mean of several readings while the prism is in an undisturbed position. As an example, we shall suppose the prism to have been carefully adjusted in the manner described, and that our readings for three positions upon the bar from the index-plate are as follows :

2d Graduation of the bar, index-reading $= 1.57 \times 2 = 3.14$ P-D.
3d " " " " " $= 1.05 \times 3 = 3.15$ "
4th " " " " " $= 0.78 \times 4 = 3.12$ "

Mean : $\frac{9.41}{3} = 3.13 +$

This precaution, in the interest of exactness, may appear to be unnecessary to some, yet it is here introduced as an exhibit in favor of the capabilities of the instrument.

The prismometer is particularly valuable when it is desired to measure the inherent prismatic action of decentred lenses, and their combinations with prisms.

In such cases it will be necessary to remove a peripheral portion of the lens by grinding it to a dull flat edge, as shown in the accompanying Figure 5.

The lens is then to be placed upon the stage with the flattened edge up, so as to cover half the stage opening ; the index-line of the transverse slide having been previously adjusted to zero (o). If, in sighting through the eye-piece, the index-line appears disjoined, it will only be necessary to shift the lens slightly to the right or left to re-establish coincidence of the lines, when the lens is said to be *centred.* While in this position ink dots should

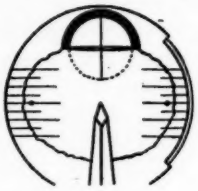


FIG. 5.

be placed upon the outer edges of the lens over a centrally situated horizontal line of the stage, as shown. For this centred position of the lens, in sighting through the eye-piece, we shall find the index-line at zero (o) unbroken, while the lower half of the index-plate will be enlarged or diminished according to the character of the lens employed. Supposing the lens be 3 D convex, we shall find the index-plate to present this view (Fig. 6) when it is placed at the graduation marked " 3 " upon the bar.

NORMAL PLATE.

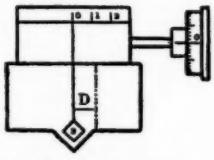


FIG. 6.—MAGNIFIED PLATE.

The lower half of the index-plate is provided with a red line, indicated by a *dotted* line in the figure, corresponding to a deflection of 1 P-D, and which appears proportionately *magnified.* As it will be inadmissible, in our readings, to place a magnified scale on a par with the normal scale of the prismometer, it will be necessary to *register* the magnified unit upon the upper portion of the index-plate, for reference and comparison during decentration of the lens. To accomplish this we displace the index-

line of the transverse slide until it coincides with the red line (dotted line, Fig. 7), which, as far as the lens is concerned, now *represents* and *takes the place of* 1 P-D on the index-plate.

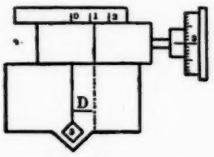


FIG. 7.

Now, by slowly shifting the lens to the left, we shall observe the lines of the lower index-plate to shift to right (Fig. 8).

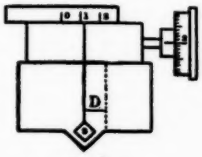


FIG. 8.

When the 3-D lens has been decentred one centimeter, experiment shows that the lower black index-line cuts the index-line of the transverse slide above. Bearing well in mind that the position of the *upper* index-line now *represents* "1," and that our reading has been taken for a position of the index-plate upon the bar at "3," we have 3 P-D as the result of decentring a 3-D lens one centimeter.[1]

In case, however, that the refraction of the lens as well as its decentration have not been previously determined it will be necessary to note the following (see Fig. 6):

It is evident that the $\frac{\text{normal plate}}{\text{magnified plate}}$ as $\frac{1}{D}$, so that the

normal prism-dioptries sought $= \frac{1}{D} \times$ magnified readings, for convex lenses, which will be when $D > 1$, and

" " " $= \frac{1}{D} \times$ diminished readings, for concave lenses, which will be when $D < 1$.

[1] "A Metric System of Numbering and Measuring Prisms," ARCHIVES OF OPHTH., xix., Nos. 2 and 3, 1890.

It is therefore only necessary to divide the magnified or diminished readings by D.

The value of D, as we have seen, is determined by first *centring* the lens. It will have a different value for different lenses, and will depend upon the distance of the lens from the index-plate. In fact, D represents the magnifying or diminishing power of lenses for any position of an object, when viewed through them, and which may be placed within their respective focal distances. For the 3-D convex lens, at the graduation upon the bar marked "3," measurement by the instrument shows D to be equal to 1.2, Fig. 7. Suppose we decentre a + 3-D lens until we obtain a reading say of 0.6 P-D, which is of course a *magnified* reading, we then have $\frac{0.6}{D} = \frac{0.6 \text{ P-D}}{1.2}$ (magnified reading) = 0.5 normal P-D at the distance "3," or 1.5 normal P-D at the meter-plane.

In measuring sphero-prismatic lenses we shall therefore find that the value of the constant prism can either be increased or diminished by a decentration of the lenticular element of the combination, a decentration of 5 *mm* in the above instance being sufficient to contribute 1.5 P-D. ad- or ab-ductive as occasion may demand.

By such means it will be possible to *counteract* the inaccuracies which *invariably* exist in the constant prism after the combination has been ground. When the lens is combined with a prism the flattened dull edge should be cut parallel with the true base-apex line, the latter being registered with ink dots and adjusted upon the stage as usual.

The most ready means of measuring such a combination—for example, + 3 D spherical combined with 2 P-D (constant prism) — will be to place the index-plate at the distance upon the bar marked "3," when, as before, the lens magnification D = 1.2, and which may be more conveniently determined by *previously centring* a spherical lens of the same refraction. Now, by deductive reasoning, we know that 2 *normal* prism-dioptries will be equal to $\frac{2}{3}$ P-D at $\frac{1}{3}$ the distance, and this would require to be 1.2 *greater* at the *same* distance to appear as the properly proportioned magnified deflection seen through the lens, consequently $\frac{2}{3}$ 1.2 = 0.8 magnified prism-dioptries. We therefore set the line of the transverse slide so as to read 0.8 P-D at the distance marked three ("3") upon the bar, and proceed to decentre the lens until the lower index-line cuts it, when we shall have the desired 2 *normal* prism-dioptries. We may utilize the rule to

prove the result: 0.8 mag. P-D $\times$ 3 $= \frac{2.4}{D} = \frac{2.4}{1.2} = 2$ *normal* P-D. Since lenses are capable of providing as many prism-dioptries as they possess lens-dioptries of refraction, it also follows that we shall occasionally be enabled to secure a considerable proportion of prismatic action by decentration alone, provided the spherical lens is of proportionately greater strength. For instance, the 3-D lens will produce 3 P-D for a decentration of 1 *cm.* so that an available decentration of $3\frac{1}{3}$ $^{mm}/_{m}$ could in itself be relied upon to furnish 1 P-D of the 2 P-D in the lens forming the subject of our example.

To facilitate measurement of concave sphero-prismatic lenses the stage is provided with a rotating disk, within, containing three prisms of varying power, with their bases down, and which may be successively carried before the lower half of the opening in the stage as occasion may demand.

The object of these prisms is to counteract the prismatic action in the vertical plane, which would otherwise manifest itself by a confusion of the transverse slide in its contact with the lower portion of the index-plate (Fig. 9), as a result of sighting through the

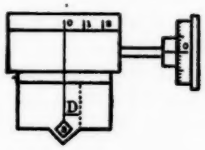


FIG. 9.

upper peripheral edge of a concave lens (acting as a prism with its base up) when placed in proper position on the stage. The extent of the confusion of the parts, as shown in the figure, will naturally depend upon the strength of the lens, so that rotation of the disk will reveal the prism best calculated to re-establish contact, as shown in Fig. 10.

Our choice of the prism being made, the lens is to be removed from the stage so as to *rectify* the position of the disk-prism before the index-line at zero (0), which should naturally present a *perfect* vertical line to view.

As an example, let us suppose the combination — 3 sph. $\bigcirc$ 2 P-D (constant prism) to be presented for measurement. We should first select a concave 3-D lens, centring it upon the stage

as described, and discover a confusion of the index-plate, at "3" upon the bar, as shown in Fig. 9.

It will be found that the first prism of the disk proves sufficient to re-establish contact, as in Fig. 10.

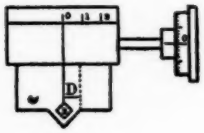


FIG. 10.

Removing the lens, *rectifying* the disk-prism, and *replacing* the lens, we find the diminishing power of the lens D = 0.83. Our object being to secure 2 P-D at the meter-plane, it follows that $\frac{1}{3}$ of this will have to be the reading from the index-plate at "3" upon the bar, or $\frac{2 \text{ P-D}}{3} = 0.67$ in the absence of diminishing power, and consequently $0.67 \times 0.83 = 0.55$ as a result of diminution by the lens.

The index-line of the transverse slide is therefore to be set to 0.55. The spherical lens is now to be replaced by the sphero-prismatic lens, with its base-apex line marked and adjusted upon one of the horizontals of the stage, and shifted upon this to the right or left, until the lower index line cuts the index line of the transverse slide. While the sphero-prismatic lens is in this position, an ink dot is to be placed upon it at the knife-edge, as the dot is intended to ultimately occupy the centre of the frame in which the lens is to be mounted.

Such can be the accuracy of the optician's work, with the aid of the prismometer for the metric system, and of which oculists in America may readily avail themselves by a simple request to have their diagnostic prisms re-numbered by measurement upon the instrument. By these explanations I hope to have succeeded in conveying the fact, that my object has not only been to promulgate a *theory*, but also to render it *useful* and fully *subservient* to *practice*, in the absence of which it should, like many another, only live in minds, and mould in books.

ORBITAL OPTIC NEURITIS, INCLUDING ALCOHOL AND TOBACCO AMAUROSIS.[1]

By H. KNAPP, M.D.

THE singular cases in which people notice a haze, a blurr, even a perfectly dark patch, in the centre of their field of vision, known under the name of central amblyopia or central scotoma, as well as those cases in which persons lose their sight in one or a few days without exhibiting symptoms of any ocular or general disease to account for this appalling occurrence, were, more than twenty years ago, accounted for by A. v. Graefe[2] and Theo. Leber[3] by the supposition of an inflammation in the orbital part of the optic nerve, **retrobulbar neuritis.** By anatomical investigations during the last ten years, this hypothesis has been proved to be a reality, as we shall see further on.

Retrobulbar neuritis may be idiopathic or the result of different kinds of intoxication, alcoholism, nicotinism, lead-poisoning, diabetes, syphilis, etc. It has an acute and a chronic form.

A.—Acute retrobulbar neuritis.

SYMPTOMS.

1. *Headache*, in various degrees, sometimes quite severe.

2. *Orbital pain*, increased by movements of the eye and pressure upon it.

[1] Read before the New York Academy of Medicine to introduce discussion of the subject, Dec. 18, 1890.

[2] On Neuro-Retinitis and Certain Cases of Fulminant Blindness. His *Archives*, xiv., 2, pp. 114–149 (see particularly pages 146–149), 1866.

[3] Amblyopia with Central Scotoma. *v. Graefe's Arch.*, xv., 3, p. 65, etc., 1869; and "Gräfe-Sämisch's Handbuch," vol. v., p. 809, 1876.

3. *Impairment of sight*, in all degrees. It may begin without any warning and advance rapidly, leading, in exceptional cases, to total blindness of both eyes in a day or two.

4. *Central scotoma*, for color and form. It may be of little intensity or so marked that no object is recognized in its area—partial and complete (or absolute) scotoma. The peripheric boundaries of the visual field remain normal.

5. *General diminution of color-perception.*

6. *Moderate retinal congestion and serous effusion* of the optic disc and adjacent retina. This condition may be followed by *ischæmia*, or the latter may be noticed from the beginning. The congestive swelling is to be considered as the distal boundary of the inflammatory focus, whereas the ischæmia is the result of the compression of the retinal vessels by the inflamed parts in the orbit.

7. The *termination* reveals three ophthalmoscopic pictures:

(*a*). Normal condition;

(*b*). Partial atrophy—always in the temporal half—of the optic disc;

(*c*). General atrophy of the optic nerves.

ETIOLOGY.

1. *Exposure and overwork.*

2. *Acute infectious diseases*, *e. g.*, measles, diphtheria, rheumatism, etc.

3. *Alcohol, nicotine, opium, lead poisoning*, etc.

4. *Suppression of menses.*

5. *No assignable cause.*

PROGNOSIS. Doubtful. We find complete and permanent recovery and partial recovery of sight, as well as permanent blindness, sometimes with preservation of one or several islets in the visual field, like oases in the desert. Their explanation later on.

TREATMENT. Rest, diaphoresis, salicylate of soda, mercury, iodide of potassium.

Let me detail one **illustrative case** from my own practice.

May 5, 1883, I was called to see Mr. Nathan Steinam, of New York City, forty years old, a successful merchant, healthy, without a constitutional taint, with no bad habits. The previous day

he had complained of nausea and severe headache. In the evening his sight was dim ; the next morning he was totally blind in both eyes. I found S = o, both pupils large, immovable, eyeballs of normal tension, their movements undisturbed. The media clear, the retinal arteries small, the veins enlarged and tortuous, the retina in the vicinity of the disc turbid, *i. e.*, a slight degree of congestive neuro-retinitis. The patient was a well man excepting his binocular blindness, and that he passed only a few ounces of urine during the day. The two next days the same condition. The urine drawn with a catheter still scant, but free from albumen, casts, and sugar. On the fourth day he passed more urine. Eyes the same, arteries more filled, but no pulsation on pressure ; veins dark, like thrombosed. Dr. Wiener, his family physician, Dr. Wm. H. Draper as consultant, and myself thought that the patient suffered from a uræmic attack. On the seventh day he had a spell of somnolence, but recovered soon and felt well. The excretions of urine became normal, the retinal arteries filled gradually to about two thirds of the natural calibre and pulsated on pressure, the veins lost their turgescence, the retina became transparent, and in about six weeks the optic discs were white, distinctly atrophic. Seven weeks after the onset of blindness he had, at various hours of the day, transient glimpses of light, during which he recognized the window and a lamp, both of which he correctly localized. When I came to see him I never could verify these observations, and was inclined to consider them as subjective sensations of light ; yet the patient, a man of well-balanced mind, positively asserted that he had seen light, though it disappeared quickly. He was treated with salicylate of soda, calomel *refracta dosi*, strychnia hypodermically, large doses of iodide of potassium, electricity. Dr. A. L. Loomis, in consultation, was of the opinion that some cerebro-spinal lesion would sooner or later manifest itself.

Thus far, almost eight years, no general disease whatsoever has appeared. The patient is physically and mentally as well as any person of his age. He goes regularly to his business, and is an intelligent and cheerful man, resigned to his loss of sight. But what has appeared is an islet of useful vision nasally and downward from the point of fixation in the visual field of the right eye, in which he counts fingers at a distance of 15′. Yet he takes in only three fingers at a glance and has slightly to move the eye to see the others. This represents an angle of a little

over 1°. His optic discs are perfectly white, the blood-vessels about two thirds the normal calibre. The arteries pulsate on pressure. The picture resembles that of atrophy after total embolism of the central retinal artery. On examination, a few days ago, the patient's general and ocular conditions were found unchanged.

B.—Chronic retrobulbar neuritis.

SYMPTOMS.

1. *Diminution of sight*, binocular, gradual, yet in some cases with acute aggravations.

2. *Day blindness*, patients see better in the dusk, the disease first described by Arlt under the name of nyctalopia. The patients complain of a fog and are dazzled; at night they feel more comfortable, but in reality see no better.

3. *Diminished color-perception*, contrast shadows not distinguished.

4. *Central scotoma*, at first for colors, then for forms (absolute). Ring scotoma, by restitution of the central part.

5. *Diminished range of accommodation.*

6. *Boundaries of visual field normal.*

7. According to the stage of the disease we find *ophthalmoscopically:*

(*a*) Fairly normal condition or slight congestion.

(*b*) Sector-like atrophy in the lower outer part of the optic disc.

(*c*) General atrophy of the od.

OCCURRENCE.

Almost exclusively in males, and in the great majority of cases from abuse of *alcohol or tobacco*, or more frequently *of both.* Opium, stramonium, lead, carbon sulphide, malaria, syphilis, diabetes, rheumatism and gout are mentioned as causes. Of late cases have been reported as sequels of epidemic influenza.[1]

PROGNOSIS good in the first stage, when no atrophy of od.

[1] Bergmeister, *Wien. klin. Wochenschr.*, 1890, No. 11. Landsberg, *Centralbl. f. Augenh.*, May, 1890, p. 141. Remak, *ibidem*, July, p. 201. C. M. Hansen, *West. Med. Reporter*, Oct., 1890, p. 231. Eperon, *Progrès Méd.*, Dec., 1890, p. 471.

is present. Rarely ending in complete blindness. The triangular atrophy of the od. may persist, but sight become normal again. Incomplete recovery is the rule.

TREATMENT.—Insist on total abstinence from alcohol and tobacco. Order strychnia, iodide of potassium, turkish baths, pure and invigorating air—sea, mountain, forest. Strychnia hypodermically, gr. $\frac{1}{30}$ or more, acts as an excitant and a tonic, with transient improvement of vision.

Diagnosis of cases of retrobulbar neuritis.

I beg to make a few remarks about the *examination of such patients.* The majority complain of impairment of sight. With test types at a distance we find both eyes affected, S from $\frac{20}{30}$ down to counting figures at several feet, excentrically.

Near by they require stronger glasses than their age and amblyopia would warrant.

Their field of vision has normal boundaries.

With the O S we notice one of the three stages: no abnormity, atrophy on temporal side, or general atrophy of the optic disc.

Examining for color-perception, we find that the patients of the last category are color-blind, those of the second recognize pigments well enough, but fail in contrast shadows; all of them show a color scotoma. The best mode to find this out is to hold a small piece of colored paper, not more than 3 *mm* long, with a pair of forceps in the visual line while you look at the patient's eye and let him look at yours. He will either be unable to see the color, especially green or red, or will confound it with another. If you want to measure the extent of the scotoma the handiest instrument is the perimeter of Schweigger. We shall, of course, not omit to examine the patient's general condition as to the well-known symptoms of alcoholism, and the other diseases mentioned before.

Pathological anatomy.

Von Graefe in 1866, and Leber in 1869, found the pallor in the temporal half of the od. and pronounced it to be the result of retrobulbar neuritis. Leber felt confident

that the anatomical proof would soon be furnished. This was done in 1880 by Samelsohn[1] of Cologne, and Nettleship and W. Edmunds[2] of London. These investigators ascertained that in a limited area of the optic nerve there were augmentation of nuclei, hypertrophy of connective tissue, and waste of nerve fibres, *i.e.*, *interstitial, sclerosing inflammation*, in the same way as alcohol produces cirrhosis of the liver.

Following up the process from the eye toward the brain they discovered that the degenerated segment near the eye had the shape of a triangle, with its base on the lower outer margin of the nerve, its apex at the central vessels. Toward the brain it gradually passed from the periphery of the nerve to the centre, which it reached in the optic canal. A case of Vossius,[3] and one of Sachs,[4] confirmed these investigations. The authors followed the atrophic segment into the chiasm and the optic tracts.

The white sector in the od. seen with the O S is, of course, the direct observation, *intra vitam*, of the atrophic segment. I have repeatedly seen it, and pass a number of sketches around. By these investigations the course of the papillo-macular fibres through the optic nerve is traced, and we know now what is the lesion in central amblyopia from alcoholism and kindred affections. Some years ago, after my attention had been directed to this triangular optic atrophy in alcoholism, etc., I was astonished to find it clear and well marked in one eye of a healthy and absolutely temperate girl, of eighteen years of age. On further examination I noticed that there was, in that eye, **a coloboma of the macula lutea.** Since that time I have found the same in other cases of macular coloboma. This affection being either a congenital defect, or the result of choroidal hemorrhage or circumscribed exudation, gives, according to Gudden's law of ascending atrophy, a neat confirmation of the position of the macular fibres in the optic-nerve entrance. In a recent paper, by G. Lindsay Johnson,[5]

[1] *Graefe's Arch.*, 1882, No. 1, pp. 1–109.
[2] Trans. Ophth. Soc. Un. Kingdom, 1881, p. 124, etc.
[3] *Graefe's Arch.*, xxviii., 3, p. 301.
[4] THESE ARCHIVES, 1889, p. 133.
[5] THESE ARCHIVES, 1890, pp. 1–29.

of London, on extra-papillary colobomata, which is illustrated by excellently executed colored drawings, there are several cases of coloboma of the macula lutea which show this triangular atrophy of the od.

An excellent paper by Dr. W. Uthoff, of Berlin, appeared, four years ago, in *Graefe's Archiv*,[1] on the Influence of Chronic Alcoholism on the Human Visual Organ. Uthoff utilizes a clinical material of 30,000 patients (Schöler's Klinik), and has examined, in different asylums of Berlin, 1,000 inebriates functionally and ophthalmoscopically. He found the triangular white atrophy of the od. in 14%. Of six fatal cases he received the eyes and examined them with the microscope most thoroughly. I pass his plates round, exhibit some with the magic-lantern, and am happy to show you under the microscope some of his specimens which he had the kindness to present me with. The one shows the central interstitial neuritis in the period of nuclear infiltration, the other in the stage of connective-tissue hypertrophy. The process is characteristic by the limitation of its area of inflammation, circumscribed and triangular near the disk, of which we gain a view in the living with the ophthalmoscope, then oblong and round as it ascends toward the optic foramen. In one of the lantern specimens you see the changes pass like a band from the temporal border of the nerve straight across to the nasal border. This shows how the atrophy of the nerve may become total.

It is remarkable that in all the specimens a certain number of healthy nerve fibres are seen preserved in the atrophic parts. This explains on the one hand why alcoholists rarely become totally blind, and on the other why in the visual field of persons blind from retrobulbar neuritis islets of useful sight may permanently be preserved, oases in the desert, as I called them in the case reported before.

Retrobulbar optic neuritis presents an example of peripheric neuritis of great scientific and practical importance, the nature of which, correctly foretold by exact clinical analysis, has of late been verified in the most gratifying manner by pathologists. The process may start at different points of

[1] Year 1886, part iv., p. 95, and year 1887, part i., p. 257.

the nerve. Samelsohn found in his case the origin in the optic canal; in two of Uthoff's cases the changes in the nerve reached the optic foramen and entered the cranial cavity; in the four others they were present only in the distal end of the orbital portion of the nerve, at its entrance into the eye, and from 6–12 *mm* back. In all of these cases the temporal pallor of the od. was seen with the ophthalmoscope. In the fatal cases in which the ophthalmoscope showed no changes, none were found *post mortem*.

THE LENS-MEASURE OF THE GENEVA OPTICAL COMPANY.

By A. L. SMITH,
PRES. OF THE GENEVA OPTICAL COMPANY.[1]

(*With two drawings.*)

WE offer to the medical profession a new instrument intended to measure quickly and accurately the power of any form of lenses used in spectacles, and to give also the axis of cylinders. It is the invention of Mr. J. T. Brayton, of our company, and grows out of the necessity of having some means for readily determining the power of lenses without the very tedious method of neutralizing with the trial lenses. The essential features of the instrument are shown in two illustrations accompanying this communication. They are the natural size of the instrument. Of the three steel points (Fig. 1), and C B C (Fig. 2), the two outside ones are fixed, and the central, B, moves up and down easily and is held up by a spring. Upon pressing the face of a lens, as shown in the illustration, squarely and firmly upon the three points, the central point is depressed until all three touch the face of the lens, and the curvature of the lens determines the amount the central point is depressed. The lower end of the central steel rod impinges upon a segment of a cog-wheel, which mashes into a pinion carrying the index finger and controlling its movement, thus indi-

[1] Having convinced myself by daily use of the practical value of the above instrument, I asked the Geneva Optical Company to kindly furnish for publication in these ARCHIVES a description, especially of the inner mechanism, of their handy apparatus, and also to mention the name of the inventor. I thank the President for his prompt and courteous compliance with my request. —EDITOR.

cating upon the dial plate the dioptries computed from the curvature of the face of the lens which is being tested. By rotating the lens upon the three points it is instantly seen if the side which is being tested is cylindrical, spherical, or plane. If a plane surface the index points to o (Fig. 1) in all meridians.

FIG. I.

If a *cylindrical* surface it points to o when the three points are in line with the axis of the cylinder, and when rotated to the point where the highest degree of power is shown it indicates the refraction of that surface of the lens. By turning the lens over and testing the other side we instantly find the nature of that surface, and also read at once the power of a compound lens by using the two measurements given for each surface.

If it is a *bi-convex* or *bi-concave* lens we add the result of measuring each surface separately.

If a *periscopic* lens we deduct the less from the greater, for instance, if the concave side registers 1.25 and the convex plus 3.25 the lens is 2 dioptries.

The essential features of the instrument are the three points yielding to the curvature of the lens and connecting by suitable mechanism on the dial plate. The internal construction can be made in several methods on the system of levers, gears, and cogs, but the method used is the simplest form, using only a segment of a cog-wheel with teeth mashing into the central pinion (Fig. 2). There is a hair spring

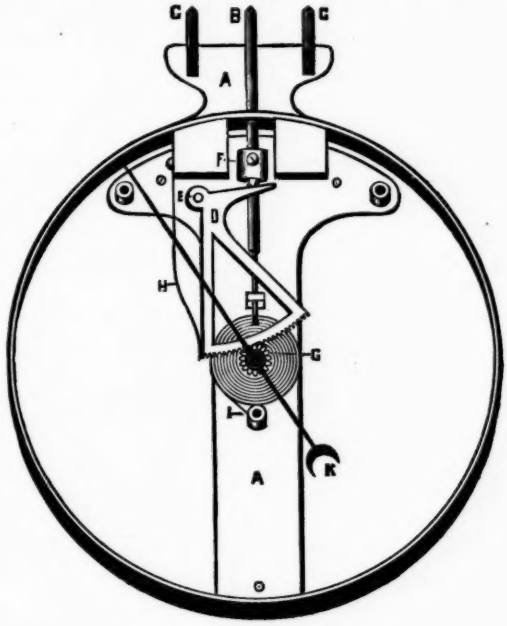


FIG. 2.

(G, Fig. 2) to take up the lost motion, the so-called "backlash," of the centre pinion, also a heavy spring (H, Fig. 2) to force the central rod constantly upwards so that it stands normal above the two outside points as shown in the illus-

tration. "The two outside steel points are fixed, but can be moved if it is desirable at any time to adjust the instrument. The middle rod is attached to a solid bar (B, Fig. 2), which slides up and down in a slot in the ground plate (A, Fig. 2) of the instrument. The bar is attached to a life-edged chain in contact with the short arm of the rack D. The fixed point of the rack (or segment of the cog-wheel) (E, Fig. 2) is made adjustable by a screw device (F, Fig. 2). At the lower part of the rack are the cogs which work the pinion to which the pointer is attached" (Tilley).

As will be seen, the instrument analyzes a lens, measuring the curvature of each surface, as the grinder does by its gauges. From the curvature the refractive power is computed and expressed on the dial in dioptries, as indicated by the pointer. The refractive power of the lens is the combination of the power of both surfaces;—their sum, if both are either convex or concave; their difference, if the one is convex, the other concave.

SUPPLEMENTARY REMARKS BY H. KNAPP.

The instrument here described and illustrated (which can be easily taken apart and studied) is, as it were, a universal gauge of the surfaces of spectacle lenses, in which, for the convenience of the oculist, the refractive power corresponding to the curvatures is indicated on a dial by a pointer which is moved by a simple cog-wheel gearing. It was first exhibited and shortly described in the Ophthalmological Section of the American Medical Association, at its meeting at Nashville, in May, 1890, by Dr. Robert Tilley,[1] of Chicago. It should in medical literature be called the lens-measure or phacometer of I. T. Brayton. It is sure to become popular among oculists, for no one who has once seen it will be slow in adding it, as an almost indispensable supplement, to his trial case of lenses. It saves a great deal of time, and is as accurate as it is convenient.

[1] *Journ. Am. Med. Assoc.*, Oct. 25, 1890, p. 597.

To test its accuracy I have tried eighteen of these instruments: sixteen were entirely exact, one like the other; one showed deviations here and there in the scale not exceeding $\frac{1}{8}$ dioptry—for instance, in a cylinder + 6 D the pointer marked the plane surface correctly 0, but the curved surface $5\frac{7}{8}$ instead of 6, as did all the other instruments; in one the hand of the dial pointed a little over $\frac{1}{4}$ D too much to the right all through. This can, of course, be easily corrected by removing the cover and setting the hand right. The inaccuracy of $\frac{1}{8}$ D in one or the other parts of the scale is probably owing to the incomplete elimination of the "back-lash" (*todter Gang*, in German, motion of machinery producing no effect), which, according to Nicholson, means the reaction upon each other of a pair of wheels, produced by irregularities of velocity, when the moving power is not uniform. The inaccuracy must be caused by some accidental derangement, for the instruments, being duplicates, should all be alike.

On the other hand, I have found far greater inaccuracies in my trial cases; for instance, in a new large case of P. Roulot's successor, $\frac{1}{4}$ D and more (up to 1 D in + 20 D) was not rare in the middle and higher numbers. As the Geneva Company's lens-measure will, without doubt, be generally introduced, it would be desirable to determine the shortcomings of the instrument or the inaccuracies in the numbering of our trial lenses, by means of a reliable phacometer —for instance, that of Snellen. The company say the computation of the refractive power from the curvature of lenses being based on the refractive index of crown-glass (to which that of pebble is practically equal), if a given lens has another focal distance than the one determined by their instrument, it is probably made of flint. In determining the axes of cylinders, I have found an inaccuracy (of about 5°) in only one of Roulot's case, which shows the remarkably exact work of this firm. The lens-measure, with printed instruction of its use, can be obtained from the company, or any reputable optician, at the price of $7,50 net.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE FIRST HALF OF THE YEAR 1890.

By H. MAGNUS, Breslau; C. HORSTMANN, and P. SILEX, Berlin.

WITH THE CO-OPERATION OF

S. M. Burnett, Washington; Dantone, Rome; Hirschmann, Charkow; E. Marckwort, Antwerp; P. v. Mittelstädt, Metz; L. Werner, Dublin; C. H. A. Westhoff, Amsterdam; Schiötz and Ole Bull, Christiania, etc.

Sections I.–V. Reviewed by Prof. H. MAGNUS.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

a—TEXT-BOOKS, MONOGRAPHS, TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS.

1. Deutschmann. Contributions to ophthalmology, first number. Hamburg and Leipzig, 1890.

2. Fox, Webster. A history of spectacles. *Med. and Surg. Rep.*, May, 1890.

3. Hirschberg. Egypt. Historical studies of an oculist. Leipzig, 1890.

4. Knies. Outlines of ophthalmology, with special consideration of the needs of students and physicians. Second edition, 1890. The first edition of this excellent book appeared less than two years ago. Thirty figures in the text. Price, $1.50.

5. Michel. Text-book of ophthalmology. Second revised edition. Wiesbaden, 1890. The first edition appeared in 1884.

6. Mooren. Visual disturbance and compensation. *Centralbl. f. allg. Gesundsheitspflege*, vol. ix., p. 217.

7. MOTAIS. Hygiène de la vue dans les écoles et les collèges en France. *Comm. à l'acad. de méd.*, Nov. 19, 1890.

8. SCHLAMPP. Guide to the clinical methods of examining the eye. 2d. ed. (In German.) Munich.

9. STORY. The Irish licensing bodies and ophthalmic surgery. *Ophth. Rev.*, vol. ix., p. 37.

10. The hemianopic forms of the visual field and the centre of optical perception. An atlas of hemianopic defects. Wiesbaden, 1890. Excellent and exhaustive.

DEUTSCHMANN (1) presents some interesting clinical contributions, the special value of which lies in the thorough examination of the pathological anatomy of the cases. Papers on the following subjects are among the contributions: Injury to the eyes, and antiseptics. Remarks on the pathology of the optic nerve and its entrance. Homonymous hemianopsia after injury to the skull. On amaurosis and auto-intoxication in carcinomatosis. Spontaneous detachment of the retina with deep anterior chamber and marked decrease of tension. Glaucoma hemorrhagicum. Some rare forms of tumor of the eyes.

FOX (2), in his paper on the history of spectacles, introduces numerous illustrations, which are of great interest. He reviews modern history in particular, while the early history of glasses is embraced in a short review of well-known facts.

HIRSCHBERG (3) has prepared three excellent historical papers. The second one is of special importance: "The ophthalmology of the ancient Egyptians," in which Hirschberg attempts to give an explanation of the eye diseases mentioned in the papyrus Ebers. This attempt is extremely difficult, and calls for extensive knowledge on widely different subjects; but in spite of the difficulties, Hirschberg has succeeded in a most admirable manner. The first paper: "Egypt as a climatic resort," is of general interest. In the third paper the examination of the first reports on Egyptian ophthalmia is notable.

MOOREN (6) calls attention to the fact that the excellent method of Zehender of computing the loss of wage-earning power from visual disturbances is defective, because it takes into consideration only central vision. He proposes the universal acceptance of the formula computed by Jaesche on the basis of Zehender's formula.

11. AMSTERDAM. Seventeenth report for the year 1889.

12. BALTIMORE. Twelfth annual report of the Presbyterian Eye, Ear, and Throat Charity Hospital.

13. HERRNHEISER. Report on the ophthalmic clinic of Prof. H. Sattler, for the year 1889. *Prager med. Wochenschr.*, 1890, Nos. 15 and 16.

14. KLEIN. Seventh annual report from the Ophthalmic Institute at Neisse. From February, 1889, to Jan. 31, 1890, inclusive.

15. ORLOWSKY. Report on the eye-patients in the private country practice for 1887 to 1889, inclusive. *Wjest. Ophth.*, May-June, 1890.

16. RÜCKERT. Fourteenth report on the Ophthalmic Institute at Zittau for 1888 and 1889.

17. SCHIES-GEMUSEUS. Ophthalmic Institute at Basel. Twenty-sixth annual report from Jan. 1 to Dec. 31, 1889 inclusive.

18. SCHREIBER. Seventh annual report on the Ophthalmic Institute at Magdeburg from Jan. 1 to Dec. 31, 1889 inclusive.

19. STUFFLER. Relazione clinico-statistica del quadrimestre Luglio–Ottobre, 1889. *Rass. di scienz. med.*, vol. v.

20. UTRECHT. Thirty-first annual report.

21. WAGNER. Short report on the City Ophthalmic Institute at Odessa for 1888 and 1889. *Wjestn. Ophth.*, May–June, 1890.

22. THE WILLS EYE HOSPITAL. Report for the year ended Dec. 31, 1889. Philadelphia, 1890.

23. WOLFFBERG. On statistics of eye-diseases, with a diagram for affections of the lids. Supplement to the jubilee report in honor of the twenty-fifth anniversary of the existence of the Institute. Breslau, 1890.

GUNNING (11) reports on 8,128 patients, with 41 extractions and 116 tenotomies.

In BALTIMORE (12) 5,924 patients were treated; 33 extractions with, 60 without, iridectomy.

In PRAGUE (13) 3,430 new patients were treated; May and June furnished the largest number. Operations, 1,026, among them 213 extractions according to Graefe, only 1.5 % of which failed on account of suppuration. Iridectomies, 158. In one case a cysticercus was extracted from the vitreous.

KLEIN (14) treated 1,282 new patients and performed 146 operations, among them 28 extractions.

The number of eye-patients (15, Orlowsky) was 2,039, being equal to 19 % of the total number, 10,686. Detailed figures cannot be given. In trachoma, which comprised 20 % of all eye-patients, ORLOWSKY carefully presses out the granulations with the fingers, repeatedly, if necessary, washes out the conjunctival sac with a solution of sublimate, 1:1,500, and rubs iodoform powder into the bleeding parts. The following day he touches the lids with a solution of nitrate of silver (2 %), or of sulphate of copper in glycerine (6 %). When the secretion ceases and no new granulations appear, the patients are discharged with the yellow salve (1:120). He claims that the granular form is cured by this method in from four to six weeks. In the treatment of blennorrhœa and hypopyon iodoform and sublimate solutions are extensively used. The number of major operations was 379 on 260 patients, among them 220 extractions, with a loss of 3.2 %. HIRSCHMANN.

In ZITTAU (16) 6,246 new patients were admitted in the last two years. Number of extractions, 129. An obituary of Just is added to the report.

At BASEL (17) 2,206 patients were treated at the dispensary, 531 clinically. A large number of clinical histories are added.

SCHREIBER (18) treated 2,046 patients. Twenty extractions according to Graefe, with one loss. Number of extirpations of the lachrymal sac, 36. He adds a short paper on bromethyl narcosis and a clinical history (primary sarcoma of the ciliary body).

In the ophthalmic division, in charge of Saltini, of the hospital at Modena 1,268 eye-patients were treated during the four summer months according to STUFFLER (19). Number of operations, 118. The writer advocates the use of a 3-% solution of nitrate of silver in trachoma. DANTONE.

In UTRECHT (20) 3,392 new patients were treated. Number of extractions, 47.

The number of patients (21, Odessa) for 1888 was 2,862, in-door patients, 462; for 1889, 3,280, in-door patients, 423. Number of extractions according to Graefe, in 1888, 122; all good; in 1889, 106, with 5 losses. HIRSCHMANN.

In PHILADELPHIA (22) 9,436 new patients were treated. Extractions, 86 with, 5 without, iridectomy; 63 enucleations.

WOLFFBERG (23) justly calls attention to the numerous sources of error which the statistics of the different institutions contain, and makes propositions to overcome them.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPEUTICS.

a.—GENERAL PATHOLOGY AND DIAGNOSIS.

24. BASEVI. Delle imagini suggettive. *La Spallanzani*, vol. xxviii., 5.

25. GARNIER. The changes in the ciliary muscle under the influence of age and refraction. *Wjestnik Ophth.*, Mar.–Apr., 1890.

26. NAUMOW. On some pathologico-anatomical changes in the fundus of the new-born child. *Inaug. Diss.*, St. Petersburg, 1890.

In 11 cases of chronic glaucoma and 14 of idiopathic affection of the optic nerve, BASEVI (24) has examined the development, nature, and fading of the after-images, resulting from the influence of the individual, monochromatic spectral colors. The differences between the two diseases named, and between them and the healthy eye, were so marked that the author thinks they could be used for diagnostic purposes. DANTONE.

From microscopic examination and measurements of the ciliary muscle in eyes of persons of different age and refraction, GARNIER (25) arrived at the following results: in new-born and prematurely-born children the part of the ciliary muscle adjacent to the insertion of the iris is drawn forward with the root of the iris, there being no anterior chamber. The anterior chamber is not the result of the functioning of the eye, but of progressive development, as he discovered in an eye of a child born six weeks beyond the time. The circular fibres are present in the ciliary muscle of all new-born children, and must be considered an integral part of that muscle. Exercise, of course, can develop the muscle (functional hypertrophy); the circular fibres may increase, which, however, depends less upon the original refractive condition of the eye (which is usually hypermetropic in the new-born) than upon the demands made upon it. The structure and form of the ciliary muscle vary very considerably. The author doubts a separate development, or atrophy of particular parts of the muscle, on account of the uniform action and innervation of its different parts. HIRSCHMANN.

NAUMOW (26) examined under the microscope 47 pair of eyes of mature children which had died during birth, or soon afterwards, and 22 pair of eyes of prematurely born children (10 pair of 7 months' and 12 pair of 8 months' children). Nothing pathologi-

cal was found in the latter. In 12 pair—*i.e.*, 25.5 per cent. of the mature children, there were pathological changes as follows: hemorrhages in and upon the retina and choroid, œdema of different parts of the retina and of the optic nerve, infiltration, with a small-celled mass and optic neuritis in an early stage. The hemorrhages are particularly numerous in the region of the macula, and are sometimes quite large; they generally occur in the inner granular layer, seldom in the layer of ganglion cells; in the peripheric parts of the retina, however, they generally occur in the latter layer, rarely in the former. Sometimes they are small, but occasionally rupture the membrana limitans interna. Naumow attributes congenital weakness of sight to such hemorrhages in the region of the macula lutea. Congenital amblyopia and atrophy of the optic nerve may result from the choked disk mentioned above. The so-called central coloboma he ascribes to a large hemorrhage which had occurred during birth. HIRSCHMANN.

b.—GENERAL THERAPEUTICS.

27. COSTOMIRIS. Du massage oculaire au point de vue historique et therapeutique et surtout du massage direct de la conjonctive et de la cornée. *Arch. d'ophth.*, vol. x., No. 1.

28. MEIFFERT. Considérations sur l'énucléation de l'œil. *Thèse de Lyon*, 1889.

29. SCHEFFELS. On resection of the optic nerve. *Zeh. klin. Monatsbl. f. Augenhk.*, 1890, p. 197.

30. SIMI. Sulla enucleazione. *Boll. d'ocul.*, vol. xii., p. 3.

COSTOMIRIS (27) begins his somewhat lengthy paper with an historical review, which shows that massage of the eye was known to the old Greeks, and was used by Hippocrates and Galenus according to definite rules. A distinction was made according to quantity and quality, just as the author to-day uses strong, moderate, or gentle friction, which again may be brief, moderately long, or prolonged. Direct massage was not known to the ancients. This form in particular is preferred by him, and he contends that the proper form of massage, adopted to each individual case, is capable of curing even the most inveterate affections of the conjunctiva and cornea. He then describes in detail the different kinds of massage and their indications. He thinks that the remedial action must be ascribed to the massage alone,

though he uses different remedies, and recommends for strong friction pulverized boracic acid, while for moderate and prolonged friction a salve of boracic acid, or of boracic acid with acetate of lead, or of white precipitate, is useful. The yellow and iodoform salve frequently cause irritation, and are suitable only for obstinate cases. After massage the eyes are washed with collyria of acetate of lead, nitrate of silver, or boracic acid, etc. Massage can be extensively employed in trachoma with good results, as the author shows from different cases. He has also used massage with good effect in acute affections of the conjunctiva, even the severest, like blennorrhœa, croup, and diphtheria ; also in scleritis, episcleritis keratitis parenchymatosa, hypopyon, in infectious corneal ulcers, affections of the lids, œdema, echymoma, and tenonitis. In internal affections massage is useless, except when, as in secondary glaucoma, iritis, or cyclitis, it is due to a corneal affection. v. MITTELSTÄDT.

From the experience of Gayet, MEIFFERT (28) prefers enucleation to every other operation, for instance, evisceration, amputation of the anterior portion, etc. Recovery is rapid, and of course there is no chance for vision in any of the other operations. A conjunctival suture after enucleation is rather injurious than useful. MARCKWORT.

SIMI (30) thinks that enucleation of the eyeball has been abused. No general indications can be formulated, but every case must be carefully considered. DANTONE.

III.—INSTRUMENTS AND REMEDIES.

a.—INSTRUMENTS.

31. CHIBRET. Un optomètre de poche fondé sur une propriété des progressions. *Soc. d'ophth. de Paris*, Feb. 4, 1890.

32. LEPLAT. Un instrument pour controler l'orientation des verres cylindriques. *Arch. d'ophth.*,vol. x., 1, 1890 ; *Soc. d'ophth. de Paris*, Feb. 4, 1890.

33. MADDOX. A new test for heterophoria. *Ophth. Rev.*, vol. ix., p. 129.

34. HARLAN. Periscopic cylindrical and sphero-cylindrical glasses. *Trans. Amer. Ophth. Soc.*, 1889.

LEPLAT (32) has constructed an instrument for testing the cylindrical glasses furnished by the optician, especially the position of the axes. A ring divided into degrees and provided with a

handle, is fitted with the glasses necessary for neutralizing; the glass to be tested is placed on a second ring concentrically fitted into the first and provided with an indicator. The author then describes the simplest methods for testing the different simple and combined cylindrical glasses. v. MITTELSTÄDT.

b.—REMEDIES.

35. GRÄFE-JÄNICKE. A contribution to the knowledge of pyoktanin. *Fortschr. d. Med.*, 1890, Nos. 11 and 12.

36. PANAS. Sur l'action anesthésique locale de la strophantine et de l' ouabaïne. *Arch. d'ophth.*, 1890, No. 2, Mar.-Apr.

In GRAEFE'S (35) clinic Stilling's claims of the remarkable value of the aniline dyes as antiseptics were subjected to a thorough test, the result of which was very unfavorable. Graefe's results, like those of most other authors, were unsatisfactory. As regards their clinical value, Graefe scarcely ever obtained any real results; in one case possibly a good result was observed, as he succeeded in preventing a threatening panophthalmitis in a case of perforating corneal injury. In the great majority of cases treated with pyoktanin no effect was observed, while not a small number were directly injured by it. Careful bacteriological tests showed that the germ-destroying power of the aniline dyes was much less in blood-serum than in distilled water. The various kinds of bacteria reacted differently, and were checked in their development by various solutions. Staphylococci were killed by a solution of 1:1,000 to 5,000 in half a minute, but by a solution of 1:20,000 only after ten minutes. A severe inflammation ensued in rabbits' eyes when they were touched with a pyoktanin pencil 1:1,000; the local irritation does not seem to be as slight as Stilling claims.

PANAS (36) reports on his experiments of anæsthesia of the eye with strophantine and uabaïne. In rabbits the anæsthetic effect appeared later than after cocaine, and lasted up to three hours. There were no symptoms of irritation, and the pupil remained unchanged except a slight dilatation after strophantine. In the human eye uabaïne caused neither irritation nor loss of sensibility, while strophantine rendered the cornea insensible after fifteen minutes, the loss of sensibility lasting two hours; it cannot be used, however, on account of the severe reaction of the conjunctiva and the marked painful smarting. An inflamed eye is not affected by strophantine. v. MITTELSTÄDT.

IV. —ANATOMY.

37. BECHTEREW. On the visual area at the surface of the cerebral hemispheres. *Arch. f. Psychiatr.*, 1890, No. 1.

38. DARKEWITSCH. On the decussation of the optic-nerve fibres. *Wratsch*, 1890, Nos. 5 and 6.

39. EWART. On the development of the ciliary or motor-oculi ganglion. *Royal Soc. London*, March, 1890.

40. MUNK. Visual area and the movements of the eyes. *Sitzungsber. d. preuss. Acad. d. Wissensch.*, 1890, iii.

41. PFISTER. On the form and size of the intervaginal space of the optic nerve within the optic canal. *Arch. f. Ophth.*, vol. xxxvi., 1.

BECHTEREW (37) arrived at the following results: (1) By unilateral destruction of the cortex in animals (dogs and cats) three kinds of visual disturbance can be produced: (*a*) binocular homonymous hemianopsia; (*b*) binocular homonymous hemianopsia with incomplete general blindness (amblyopia) of the eye of the opposite side, especially impairment of its part of most distant vision; and (*c*) incomplete blindness of the opposite eye. (2) The region of the cortex, the destruction of which causes visual disturbances, extends from behind forward, over the whole occipital and a large part of the parietal lobe, and laterally from the temporal to the inner edge of the occipital lobe, spreading out upon the inner surface of the latter. (3) In the cortex of the hemispheres there exist in reality two visual areas, which to a great extent overlap each other: the one, embracing the occipital and parietal lobes, controls the function of the corresponding halves of the retinæ; the other, lying in its greatest extent in the region of the parietal and only partly in the occipital lobe, influences the function of the opposite part of the retina. (4) Destruction of the first-named area produces homonymous hemianopsia of both eyes; destruction of the other is generally only possible with that of the first also, producing in the animal homonymous binocular hemianopsia with amblyopia of the opposite eye, especially obscuration of the region of most distinct vision. (5) The crossed amblyopia sometimes observed must be ascribed to an affection of the second area. (6) In homonymous hemianopsia due to destruction of the cortex the region of most distinct vision remains unaffected. (7) The hemianopsia due to destruction of the occipital lobe is either a complete and apparently

permanent one, or incomplete (hemiamblyopia) and temporary, according to the extent of the destruction. (8) After the re-establishment of sight in limited destruction of the occipital lobe a second complementary destruction again produces hemianopsia of shorter or longer duration. (9) In cats and dogs it is never possible by destruction of the cortex to produce a visual disturbance of the eye of the same side alone or limited disturbances of the eye of the opposite side in form of the blind spot of Munk. (10) Extensive destruction on both sides in the region of the parietal and occipital lobes produces complete blindness of longer or shorter duration. (11) Binocular (homonymous) hemianopsia with incomplete blindness of the opposite eye in some cases passes in the course of time into pure homonymous hemianopsia, in others into crossed incomplete blindness. (12) The visual disturbance resulting from destruction of the visual area of animals, and considered mental blindness by some authors, is nothing but an impairment of vision of an amblyopic nature. HIRSCHMANN.

Michel's last publication (on degeneration of the optic nerve and decussation of the optic-nerve fibres) induced DARKEWITSCH (38) to examine similar specimens in his collection and make new experiments, from which he concludes that "Michel's latest investigations by no means disprove the old assertion of Gudden, that in the higher animals an incomplete decussation takes place." Darkewitsch partly ascribes the opposite results of Michel to the fact that he has mistaken in his specimens the fibres of Forel's decussation for fibres of Meynert's commissure and the latter for fibres of Gudden's commissure. For the detailed proofs of this see the original. The author relies for proof mainly on the division in new-born cats (through the parietal bone) of the optic tract at the point where it passes upon the corpus geniculatum externum. Examination of the animal killed forty-two days after the operation (total division of the left tract) showed: left thalamus opticus hardly half as large as right; the two corpora geniculata atrophied on the right side; the left optic tract has entirely disappeared (in its place only Meynert's commissure is visible); the right tract is present, but thinner (on account of the atrophy of Gudden's commissure), than in an animal not operated upon; both optic nerves are present, the right thinner than the left, but both thinner than in an animal not operated upon. Both optic nerves contained uninjured fibres.

HIRSCHMANN.

MUNK (40) assumes that the focussing of the eyes is caused by sensations of light, from which the excitation extends in the radial fibres of the corona radiata directly to the subcortical parts of the brain. These fibres serve the involuntary movements of the eyes, which permit the latter to wander and fix themselves upon what had previously been seen indistinctly; these movements must be considered a special kind of congenital reflex, the lowest visual reflexes, which do not presuppose conscious visual impressions, but only sensations of light.

PFISTER (41) found that in very many cases there is a communication between the subdural space of the brain and the intervaginal space of the intra-orbital part of the optic nerve, passing completely around the latter. A distinct arachnoid sheath separate from the pia and dura mater does not seem to exist in the optic canal. The dura mater, however, is markedly developed, especially below the optic nerve, where the superior ophthalmic artery lies.

V.—PHYSIOLOGY.

a.—RETINA AND GENERAL PHYSIOLOGY.

42. BASEVI. Influenza dell' adattamento sulla sensibilità retinica per la luce e per i colori. *Ann. di ottalm.*, vol. xviii., 6, p. 475.

43. BERRY. A suggestion as to the function of some of the retinal elements. *Ophth. Rev.*, vol. ix., p. 134.

44. CHARPENTIER. Recherches sur la persistence des impressions rétiniennes et sur les excitations lumineuses de courte durée. *Arch. d'opht.*, vol. x., 2 and 3.

45. LAQUEUR. On pseudentoptic visual perceptions. *Arch. f. Ophth.*, vol. xxxvi., 1.

46. LAWRENTJEW. On the influence of drawing, printing, and female fancy work upon sight. *Wjestnik obsch. Hygiea sudjebn. i pact. med.*, vol. vi., 1; *Wratsch*, 1890, No. 21.

47. MENDELSOHN. Investigations on the differential sensibility of the visual organ. *Minutes of the viii. Meeting of Russian Physicians and Naturalists.*

48. SACHS. The causes of the apparently greater proximity of the lower of two double images placed above each other. *Arch. f. Ophth.*, vol. xxxvi., 1.

49. SCHUBERT. The position of the book and the direction of the writing. Hamburg and Leipzig, 1890.

BASEVI (42) has made extensive investigations on himself and nine other young persons with normal sight as to the adaptability of the retina for white and colored light, and on the whole has obtained about the same results as Aubert, Peschel, and Treitel. The eyes were put into a condition of rest by a stay, for 15 to 20 minutes, in a room darkened with heavy curtains and therefore not absolutely dark. The author found that after adaptation sight had been increased threefold, measured with Snellen's test-types, while the sense of light, measured with Treitel's tests, had been increased eighteen-fold. The latter experiment was made at a greater angle than that used by Aubert, which accounts for the great difference of result. While measuring himself with a Foerster photometer the author, while in the state of adaptation, was able to recognize the same lines as before, though the illumination had been reduced to $\frac{1}{180}$. After the eyes had been rested and light was gradually admitted, the colors were recognized in the following order: red, yellow, green, and finally blue. When the eye was exhausted for one color by a corresponding glass, that color took the last place in the row. The author found the visual field enlarged, also that for colors; but the period of rest must be longer and the test must take place in greater darkness. On the basis of these observations the author concludes that hemeralopia is a disturbance of the adaptability of the eye.

DANTONE.

CHARPENTIER (44) tries to determine the influence which the intensity, duration, and color of a luminous excitation falling upon the retina exert upon the duration of the sensation apparently continuing with the same intensity after the excitation has ceased. (For description of the apparatus and the manner of experiment see the original.) He first decides the question as to the relation to each other of the duration and intensity of a luminous excitation in their effect upon the retina. He found, as others did before him, that within a space of $\frac{2}{1000}$–$\frac{125}{1000}$ of a second the amount of light necessary for perception is inversely proportional to the time of its action, and that doubling of a certain amount of light, the time of its action remaining the same, is equivalent to doubling the duration, the intensity remaining the same. If we imagine an excitation subdivided into a large number of smallest elementary irritations (impressions

élémentaires), these elementary irritations unite within a certain time as the sensation of light increases.

SACHS (48) explains the apparently greater proximity of the lower double image in the first place by its being referred to the horopter, and in the second place by the increase in accommodation when the eyes are directed downward.

b.—COLOR-PERCEPTION.

50. BICKERSTON. Color-blindness. *Brit. Med. Jour.*, March, 1890.

51. EDRIDGE-GREEN. Two new tests for color-blindness. *Brit. Med. Jour.*, Jan., 1890.

52. FICK. The theory of color-sense in eccentric vision. *Arch. f. d. ges. Physiol.*, vol. xlvii.

53. GROSSMANN. Note on tests for color-blindness. *Brit. Med. Jour.*, Jan., 1890.

54. HERING. The diagnosis of color-blindness. *Arch. f. Ophth.*, vol. xxxvi., 1.

55. HESS. On the changes in the spectral colors produced by exhaustion of the retina with homogeneous light. *Arch. f. Ophth.*, vol. xxxvi., 1.

56. HOGG. An undetected case of color-blindness. *Brit. Med. Jour.*, April, 1890.

57. RAYMOND. Une observation colorée. *Gaz. des hôp.*, 1889, p. 680.

58. UHTHOFF. Further investigations on the dependence of the acuteness of sight upon the intensity, as well as upon the wave-length in the spectrum. *Arch. f. Ophth.*, vol. xxxvi., 1.

FICK (52) defends the theory of three colors against the attacks of Herring and Hess, and shows that one of the primary colors (blue) has been undoubtedly shown to exist.

Sections VI.–XI. Reviewed by PROF. HORSTMANN.

VI.—ANOMALIES OF REFRACTION AND ACCOMMODATION.

59. FUKALA. Operative treatment of high degrees of myopia by aphakia. *Arch. f. Ophth.*, vol. xxxvi., 2, p. 230.

60. HIRSCHBERG, J. Diabetic myopia. *Centralbl. f. prakt. Augenhk.*, 1890, p. 7.

Myopia, hypermetropia, and astigmatism are the subjects of sixteen other papers, which offer nothing essentially new, and are therefore omitted in this report.—K.

FUKALA (59) has performed discission on nineteen myopic eyes with a myopia from 13 D upward. They were all young persons under twenty-four, with relatively good sight. As a result of the aphakia such myopes see better at a distance, the retinal images are enlarged, the excessive effort at convergence and its injurious consequences are removed, binocular vision for near objects is re-established, and the spasm of accommodation and the accommodation itself—two factors injuriously affecting highly myopic eyes—are done away with.

HIRSCHBERG (60) describes three cases in which a low degree of myopia had been developed in eyes good until then, in consequence of diabetes.

VII.—LIDS.

61. GRADL. The treatment of blepharitis squamosa. *Centralbl. f. prakt. Augenhk.*, 1890, p. 112.

62. CIRINCIONE. Cisto-adenoma sottocutaneo giustaposto al sacco lagrimale. *Progresso med.*, vol. iv., 18.

63. FRICKE. Case of congenital defect of the lid. *Zeh. klin. Monatsbl.*, vol. xxviii., p. 53.

64. FUCHS, E. On isolated bilateral ptosis. *Arch. f. Ophth.*, vol. xxxvi., 1, p. 234.

65. GASPARINI. Innesto di cute in caso di simblefaro con buon esito definitivo. *Ann. di ottalm.*, vol. xix., 1, p. 89.

66. LANDOLT, E. Un nouveau procédé d'opération dans le distichiasis. *Arch. d'opht.*, vol. x., 1, p. 1.

67. NICATI. Nouveau procédé de marginoplastie palpébrale. *Arch. d'opht.*, vol. x., 2, p. 160.

68. PINCUS, O. Remarks on Jacobson's operation for trichiasis. *Centralbl. f. prakt. Augenhk.*, 1890, p. 259.

69. ZIRM. The application of oblique blepharotomy. *Wiener klin. Wochenschr.*, 1890, No. 14.

GRADL (61) has treated blepharitis squamosa with a 5-% aqueous solution of chloral hydrate alternately with a pyrogallol salve (1:8). A 2-3-% sulphur ointment acted still more favorably.

CIRINCIONE (62) observed in a woman aged fifty a small tumor

about the size of a bean, which lay between the cutis and the outer wall of the lachrymal sac, was slightly movable, but otherwise closely resembled an ordinary tumor of the lachrymal sac. After the death of the patient the tumor was examined, when it proved to be a free cyst, which sprang neither from the cutis nor from the wall of the lachrymal sac, with thickened walls and transparent yellowish contents. After a careful microscopic examination, the author declared it to be an imperfectly developed adenoid, which had originated from the cellular elements of the mucous glands of the lachrymal sac. DANTONE.

In a girl aged seventeen, FRICKE (63) saw in the right eye a large congenital coloboma of the upper lid and an indicated one of the lower. In the left eye there was a small coloboma of the upper lid and a dermoid tumor at the corneal margin. In both there was at the outer canthus a lipoma resembling a dermoid.

In connection with the description of five cases of isolated bilateral ptosis in otherwise healthy women, which in three had developed at a more advanced age, and in two had existed since childhood, FUCHS (64) expresses the belief that this affection must be ascribed to atrophy of the levator. The course of the disease is always a very slow one, so that even after the lapse of many years a slight contractility of the muscle can be demonstrated. There is also atrophy of the soft parts over the levator; in some cases a slight degree of ptosis has gone before, indicating an abnormal condition of the levator. This kind of atrophy cannot be classified under any of the forms of muscular atrophy thus far known; it is, therefore, a special variety of atrophy which is confined to the levatores palpebrarum.

GASPARINI (65) reports another case of successful transplantation of skin, the transplanted piece being placed upon the raw surface after a symblepharon operation. The edges of the graft, which was taken from the upper arm, changed to mucous membrane, while the remainder preserved the nature of epidermis, and therefore had a pale-gray color. The impaired mobility of the two eyes operated upon was removed, and the successful result had remained six months after the operation. DANTONE.

For the removal of total distichiasis, LANDOLT (66) recommends the following method: The whole upper lid is divided into two layers: the anterior being composed of the skin, subdermal tissue, and eyelashes; the posterior, of the muscle,

tarsus, and conjunctiva. An incision is then made a few millimetres from the margin along the whole length of the anterior layer, dividing it into a smaller lower and a larger upper section. The lower one, being thus converted into a bridge of skin, is then displaced upward as far as possible beneath the upper, with the aid of two threads, each armed with two needles, passing them beneath the orbital margin and tying them there; the lower edge of the upper flap thus comes in contact with the edge of the layer composed of muscle, tarsus, and conjunctiva, and unites with it. The narrow bridge of skin, from which the eyelashes have previously been removed (though leaving them does not retard the healing), becomes attached beneath the flap covering it, though an incision through the latter parallel to the edge of the lid must be made a few days afterward, to allow the eyelashes to pass through, which have then attained their permanent position.

In operating for trichiasis resulting from atrophy of the edge of the lid by means of marginal transplantation, NICATI (67) does not take the flap from the affected lid, as he formerly did, but from the opposite one. His method is as follows: (1) Incision into the margin of the lid parallel to it, so as to gain space for the transplantation. (2) Formation of a flap 1-2 *mm* wide extending the whole length of the other lid and attached to its base. (3) Insertion in the groove of the affected lid, a loop of thread being passed horizontally through the base of the flap and through the ends of the groove, and then tied. (4) Three days later division of the base of the flap and separation of the lids.

Doubts have lately been expressed as to the merits of Jacobson's operation for trichiasis, transplantation of a pedunculated flap into the intermarginal space. PINCUS (68) thinks that these objections are unfounded, provided the transplanted piece of skin is entirely devoid of even the smallest hairs, and it is not made too broad. (The implantation of narrow flaps without pedicles, according to W. F. Smith, gives very good results.—H. K.)

ZIRM (69) recommends oblique blepharotomy for the cure of spastic entropium, senile entropium, and entropium under the bandage. The operation consists in dividing one of the eyelids in its entire thickness by a single oblique incision from the outer canthus.

VIII.—LACHRYMAL APPARATUS.

70. BERLIN, R. Extirpation of the lachrymal sac. *Corresp. Bl. d. allg. Mecklenb. Aerzte-Vereins*, 1890, No. 126, p. 282.

71. CHIBRET. Ablation de la grande lacrymale palpébrale. *Soc. d'opht. de Paris*, Feb. 4, 1890.

72. GILLET DE GRANDMONT. Valeur de l'élongation des points lacrymaux. *Soc. franç. d'opht.*, May 5, 1890.

73. HIRSCHBERG, J. Mumps of the lachrymal glands. *Centralbl. f. prakt. Augenhk.*, 1890. p. 77.

74. KIESELSTAB. On epiphora. *Münchener med. Wochenschr.*, 1890, No. 34.

75. NICATI. Drainage du sac lacrymal. *Arch. d'opht.*, vol. x., 2, p. 160.

76. SCHEFFELS, O. A case of acute bilateral, non-purulent inflammation of the lachrymal gland. *Centralbl. f. prakt. Augenhk.*, 1890, p. 136.

77. SEGGEL. Occlusion of the lachrymal points by contraction of the sphincter. *Zeh. klin. Monatsbl. f. Augenhk.*, vol. xxviii., p. 362.

78. VENNEMAN. Traitement de la fistule lacrymale. *Soc. franç. d'opht.*, May 5, 1890.

79. WEBSTER, D. Acute dacryocystitis. *N. Y. Med. Journ.*, vol. li., No. 12.

CHIBRET (71) removed the palpebral lachrymal gland in twenty-eight cases, and thinks he can recommend this treatment. Masselon is of the same opinion, while Galezowski, Gorecki, and Meyer are more or less opposed to it. Meyer knows of a case of atrophy of the optic nerve in consequence of suppuration following removal of the palpebral lachrymal gland.

MARCKWORT.

GILLET DE GRANDMONT (72) does not divide the lachrymal points, but dilates them with a conical probe and sounds. In suppuration of the lachrymal sac he washes it out with antiseptics. In occlusion of the lower opening of the lachrymal canal by the hyperæmic mucous membrane of the inferior turbinated bone, he treats the latter with the galvano-cautery or removes a piece of it; Armaignac particularly avoids every "mutilation" of the lachrymal apparatus; Galezowski and Abadie are adherents of the usual treatment with Bowman's probes. When this method fails,

Abadie removes a part of the lachrymal gland; Swartz de Mendoza insists that the canaliculus should not be split more than 1½–2 *mm;* Terson is not satisfied with any of the present methods.

MARCKWORT.

HIRSCHBERG (73) considers mumps of the lachrymal gland a sub-acute, non-purulent, bilateral inflammation, which causes a disfigurement of the face. He describes two such cases, which healed under lukewarm applications and iodide of potassium.

KIESELSTAB (74) calls attention to the fact that epiphora may depend upon the condition of the turbinated bones.

In suppuration of the lachrymal sac, especially the chronic form with dilatation, NICATI (75) makes an extensive incision with a very broad knife from the slit canaliculus, inserts at once a probe 3 *mm* thick, and afterwards a lead wire made of several strands, twisted together, which remains in place for three days. In almost every case this is sufficient to effect a cure. The epiphora, which sometimes lasts for a while, is due to granulations, and soon ceases. If the sac should become distended again and the introduction of probes is not followed by rapid improvement, the procedure must be repeated. v. MITTELSTÄDT.

SCHEFFELS (76) reports a case of bilateral acute inflammation of the lachrymal gland, which soon passed away after the use of iodide of potassium and applications of acetate of lead. He considers it of an infectious nature.

In lachrymal fistulas VENNEMAN (78) recommends the introduction of a strip of gauze soaked in lactic acid, in order to produce closure of the fistula. The strip is introduced once a day, and an antiseptic bandage placed over it. He claims that under this treatment the fistula closes in one to six weeks.

MARCKWORT.

IX.—MUSCLES AND NERVES.

80. AEBERLI, H. Contributions to the knowledge of nuclear paralysis of the ocular muscles. *Inaug. Diss.*, Zurich, 1890.

81. BASEVI. Le quadrigemelle come centri di azione reflessa sui movimenti oculari. *Ann. di ottalm.*, vol. xviii., 6, p. 520.

82. DUFOUR, A. Les paralysies nucléarires des muscles des yeux. *Ann. d'ocul.*, vol. ciii., p. 97.

83. GRANDCLÉMENT. Paralysie essentielle et temporaire de convergence chez les adolescents. *Soc. franç. d'opht.*, May 5, 1890.

84. JAVAL. De la stéréoscopie dans le traitement du strabisme. *Soc. f. d'opht. de Paris*, Feb. 4, 1890.

85. LAWFORD, T. Paralysis of ocular muscles in congenital syphilis. *Ophth. Rev.*, 1890, p. 97.

86. MANGNOS et GRASSET. Un cas de paralysie alterne de l'oculomoteur avec aphasie traumatique. *Progr. méd.*, 1890. No. 6, p. 105.

87. MEYER, A. On a case of ophthalmoplegia bilateralis perfecta in tabes dorsalis. *Inaug. Diss.*, Berlin, 1890.

88. STANDISH, MYLES. Partial tenotomies in cases of neurasthenia with insufficiencies of the ocular muscles. *Trans. Amer. Ophth. Soc.*, 1889.

89. WADSWORTH, O. F. Spastic torticollis, apparently due to faulty position of the eyes and cured by tenotomy. *Trans. Amer. Ophth. Soc.*, 1889.

AEBERLI (80) publishes four cases of nuclear paralysis of the ocular muscles, three of which were probably due to changes in the blood-vessels and one to injury.

In BASEVI'S (81) case paralysis of the oblique muscles, of the superior and inferior rectus of the eyes, and finally of all the associated movements had been observed ; the function of the other nerves of the head and neck was not impaired. The autopsy revealed chronic hydrocephalus with softening of the left thalamus opticus, and such a shrinkage of the corpora quadrigemina by pressure from above downward and from in front backward that they were scarcely recognizable. Comparing the disturbances of motility named above with the anatomical condition, and on the basis of seven experiments on rabbits, dogs, and cats, in which the disturbances of motility were noted after the removal of the corpora quadrigemina, the author concludes that although the centres of motion of the ocular muscles may be differently placed in the brain, there is nevertheless a common anatomical and physiological organ which must be considered the reflex centre and co-ordinator of those motions. This organ lies in the mid-brain, and is represented by the corpora quadrigemina.

DANTONE.

DUFOUR (82) discusses in a lengthy paper the nuclear paralyses of the ocular muscles. After briefly speaking of the diagnosis of the seat of the pathological changes which cause paralysis of the ocular muscles, he takes up in particular the nuclear paralyses. He describes in detail the origin of the oculomotor nerve at the floor of the aquæductus Sylvii, and of the other ocular nerves.

Dufour's diagram of their origin is that of Kahler and Pick slightly modified. He reports on 220 cases of nuclear paralysis of the ocular muscles, partly in detail, partly very briefly. A discussion of them in a review of course is impossible. In regard to the etiology and treatment the paper contains nothing particular. In regard to the prognosis Dufour asserts that there is a form of nuclear paralysis which may readily disappear. Of 177 well-observed cases 110 took a chronic course or ended fatally, while 67 made a more or less complete recovery. In conclusion Dufour gives a very complete review of the bibliography and a table of the 220 cases. MARCKWORT.

GRANDCLÉMENT (83) describes as essential temporary paralysis of convergence a gradually increasing weakness of the latter during the adolescent period, which spontaneously disappears after about the eighteenth year. In opposition to his former opinion Parinaud believes that in the so-called insufficiency of the internal recti there is not insufficiency of the muscles themselves, but imperfect innervation for convergence. De Wecker calls attention to the insufficiency of the internal-recti muscles in myopia. Landolt declares that essential paralysis of convergence must be totally kept apart from muscular insufficiency. Meyer thinks that the insufficiency of the internal-recti muscles cannot be doubted. MARCKWORT.

JAVAL (84) publishes a case by which he endeavors to prove the influence of stereoscopic exercises upon the cure of strabismus. A tenotomy had previously been made upon both internal-recti muscles. MARCKWORT.

LAWFORD (85) reports on two cases of paralysis of the ocular muscles, which certainly was due to congenital syphilis. In both there was incomplete paralysis of the oculomotor nerve.

WERNER.

In a female patient with hereditary syphilis MEYER (87) found, besides bilateral ptosis, reflex immobility of the pupil, and absence of the knee-jerk, total ophthalmoplegia of both eyes.

STANDISH (88) reports five cases of partial tenotomies of the ocular muscles for insufficiency accompanied with asthenopia, mostly with satisfactory results. He thinks cases of insufficiency comparatively rare. In testing he thinks the power to overcome prisms deceptive, and relies more on the Graefe test. The use of prisms for a time after brings out the weakness more clearly.

BURNETT.

WADSWORTH's (89) case was that of a boy aged fourteen, who held his head constantly to the right side and downward. He had never complained of asthenopia or bad vision, though in infancy his eyes had shown a tendency to roll about in a "wild" way. The left eye stood, during fixation when the head was in ordinary position, somewhat higher than the right; no stereoscopic vision in that position—images homonymous, the right higher; $V = \frac{4}{5}$; movements of eyes separately good. After tenotomy of the left superior rectus the faulty position of the head was relieved, though there is still some difficulty in obtaining stereoscopic vision. BURNETT.

X.—ORBIT AND NEIGHBORING CAVITIES.

90. BOCK, E. A cured case of caries of the orbital walls. *Allg. Wiener med. Ztg.*, 1890.

91. BULL, C. S. Contributions to the subject of tumors of the orbit and neighboring cavities. *Trans. Amer. Ophth. Soc.*, 1889.

92. CHEADLE. Exophthalmic goitre. *Brit. Med. Jour.*, 1890, p. 19.

93. CHIBRET. Subluxation du globe de l'œil gauche dans le mouvement du regard en bas. *Progr. méd.*, 1890, No. 4, p. 71.

94. FUMAGALLI. Tumore orbitale. *Ann. di ottalm.*, vol. xviii., 6, p. 546.

95. GALEZOWSKI. Des affections syphilitiques du globe oculaire et de leur traitement. *Soc. d'opht. de Paris*, March 4, 1890.

96. LANG, W. Microphthalmus with cysts of the globe. *Royal London Ophth. Hosp. Rep.*, vol. xii., p. 289.

97. LAWFORD, T. B. A further note on cases of orbital sarcoma in children. *Royal London Ophth. Hosp. Rep.*, p. 329.

98. LÖW, L. Contribution to the knowledge of enophthalmus. *Inaug. Diss.*, Berlin.

99. PANAS. Considérations cliniques sur les abscès des sinus frontaux pouvant simuler dès lésions indépendantes de la cavité orbitaire. *Arch. d'opht.*, vol. x., 3, p. 231.

100. SCHAPRINGER. Enophthalmus traumaticus ending in recovery. *New Yorker med. Wochenschr.*, June, 1890.

101. WALKER, C. H. A case of distension of the frontal sinus with mucous polypi. *Royal London Ophth. Hosp. Rep.*, vol. xii., p. 351.

102. WILLIAMS, R. Remarks on orbital tumors from mucous distension of the frontal sinus, with cases. *Lancet*, 1890, p. 456.

BOCK's (90) patient was a young shoemaker, æt. twenty-seven, in whom, probably in consequence of an injury received two years previously, caries of the walls of the orbit, with partial necrosis of these bones, had developed, extensive defects and a pathological communication between the orbital and cranial cavities being the result. The eye had been destroyed by panophthalmitis. After its enucleation, exenteration of the orbit was performed. After seven weeks the patient was discharged cured.

BULL (91) reports three cases of operation on tumors of the cavities close to the orbit. Case 1. Adeno-sarcoma of the lachrymal gland. 2. Abscess of the ethmoid cells, frontal sinus, and orbit, in a man of forty-six years, who had suffered long with naso-pharyngeal catarrh. The frontal sinus was opened and treated successfully. Case 3 was an unfortunate one of what was probably a myxo-sarcoma of the maxillary antrum, nasal fossæ, ethmoid cells, orbit, and cranial cavity, in a man of fifty-seven years, who had also been subject to naso-pharyngeal catarrh. The eye and portions of the tumor were enucleated for the purpose of contributing to the patient's comfort, which it did. He died comatose. BURNETT.

CHEADLE's (92) patient, a man, had shown marked symptoms of Graves' disease since 1868. The thyroid gland was so enlarged that it often caused dyspnœa. He continued to improve under tincture of iodine given internally, and remained perfectly well even after twenty years. The author thought from his observations that the tendency was to slow recovery in from one to five years. WERNER.

CHIBRET (93) reports a case of subluxation of the eye. It occurred for the first time when the patient, a girl aged eight, stooped to pick up an object from the floor. She had previously had the whooping-cough. When the child stooped in Chibret's presence subluxation at once took place, but the eye went back spontaneously as well as upon slight pressure. After wearing a compressive bandage for twenty-five days the child recovered, no further subluxation taking place. MARCKWORT.

FUMAGALLI (94) successfully removed a tumor 4 *cm* long and 2 *cm* thick from the lower inner corner of the orbit, with preservation of the globe and sight. DANTONE.

Galezowski (95) describes a case of exostosis in the region of the right eyebrow and forehead in a boy aged nine years. As he came to the conclusion that hereditary syphilis was the cause, he gave iodide of potassium in 2- to 3-grm. doses daily and began inunction, from which, however, he was obliged to desist after two weeks on account of salivation. After the prolonged use of iodide of potassium the exostosis disappeared.

Marckwort.

Lang (96) describes the anatomical appearances of a congenital cyst of the lower lid associated with microphthalmus. The other eye was normal. On excision it was found that the cyst was adherent to the small eyeball at the lower border of the optic nerve, its thin wall was continuous with the sheath of the nerve behind and with the sclerotic in front, and its cavity communicated through a narrow neck with the interior of the globe. The choroid terminated at the neck of the cyst, while the retina extended a short distance over it. The lens was large in proportion to the eyes, and brown in color. There was also a coloboma of the iris below.

Werner.

After a discussion of enophthalmus and its causes, Löw (98) reports two cases which were due to an injury. In both of them the optic nerve became pale, indicating an injury to the orbit.

Panas (99) saw in the course of a year four cases of abscess of the frontal sinus, and calls attention to their diagnostic aspect, as none of them had been recognized by others. In all cases of suppuration from the upper edge of the orbit there may be an affection of the frontal sinus, the extent of which may be very great, so that abscesses and fistulas may appear in the middle and even at the outer edge of the entrance to the orbit. The absence of ozæna does not speak against an affection of the sinus. *Frontal headache* is characteristic ; it is never absent, and is explained by the abundance of fibres of the fifth nerve in the mucous membrane of the frontal sinus. In treating the disease the author makes an incision directly below the eyebrow and another perpendicular to it upon the base of the nose. The triangular flap thus formed is detached from the bone together with the periosteum, and the bone is then trephined. The further treatment consists in the irrigation with a solution of bromide of mercury 1:20,000 and introduction of a drainage tube. From his studies on corpses he thinks it is possible to extend this drain into the nose. He has not yet tried which method produces more

rapid results, but a cure always requires months. No cerebral symptoms have thus far been observed. v. MITTELSTÄDT.

SCHAPRINGER (100) reports that after a fall upon the right temple ptosis of the right upper lid, enophthalmus, and diminution of the tension of that eye developed in a girl aged seven years. After four days this condition had completely disappeared. He thinks it may have been due to paralysis of a peripheral branch of the sympathetic nerve of the head, caused by pressure of a small hemorrhage.

WALKER'S (101) patient, a boy aged eighteen, had received an injury when three years old which left a scar on the brow. When first seen he had proptosis due to abscess in the roof of the orbit, which pointed at the outer end of the eyebrow. It disappeared, but recurred twice; the third time, a hole was discovered in the orbit through which a large polypus protruded, which was removed. Course of healing smooth. WERNER.

WILLIAMS (102) alludes to the difficulty of diagnosis of tumors of the orbit before fluctuation has appeared. WERNER.

Univ of M

MISCELLANEOUS NOTES.

C. A. Coccius, born in 1825, died November 24, 1890. He studied in Leipzig, Prague, and Paris. From 1849 to 1857 he was assistant to the chair of ophthalmology (Ruete) and lecturer at the University of Leipzig; from 1857 to 1867 he was extraordinary, and from 1867 until his death ordinary, professor of ophthalmology and executive surgeon of the University Eye Hospital in Leipzig. His youth fell in the initial period of ophthalmoscopy, when every look through the wonderful instrument was a discovery. Helmholtz's first publication, "Description of an Eye-Mirror," in 1851, was followed by Ruete, who introduced the concave perforated mirror in 1852, in a large and rather unwieldy form, which Coccius replaced by a handy instrument, a plane mirror with a convex lens as reflector. This instrument gained a certain popularity, and v. Graefe used it all his life.

Coccius enriched the theory and practice of eye-surgery by many very important discoveries, of which we mention: the venous pulse on the optic disk; the ophthalmoscopic appearances of the fundus oculi, especially of the yellow spot, with the reflex of the fovea; the determination of the seat of opacities in the media of the eye. Among his numerous scientific contributions the following are most valuable: On the Nutrition of the Cornea (1852); On Glaucoma, Inflammation, and Autophthalmoscopy; A Simplified Ophthalmometer (the doubling of the images produced by a tourmaline plate); several papers On the Mechanism of Accommodation.

Coccius was an original thinker and a fertile investigator whose name occupies a prominent position in the first period of ophthalmoscopic discoveries. His therapeutic, in particular his operative, peculiarities were not always felicitous. He was a successful practitioner, a popular teacher, and a kind man.

H. K.

Fig. 1.

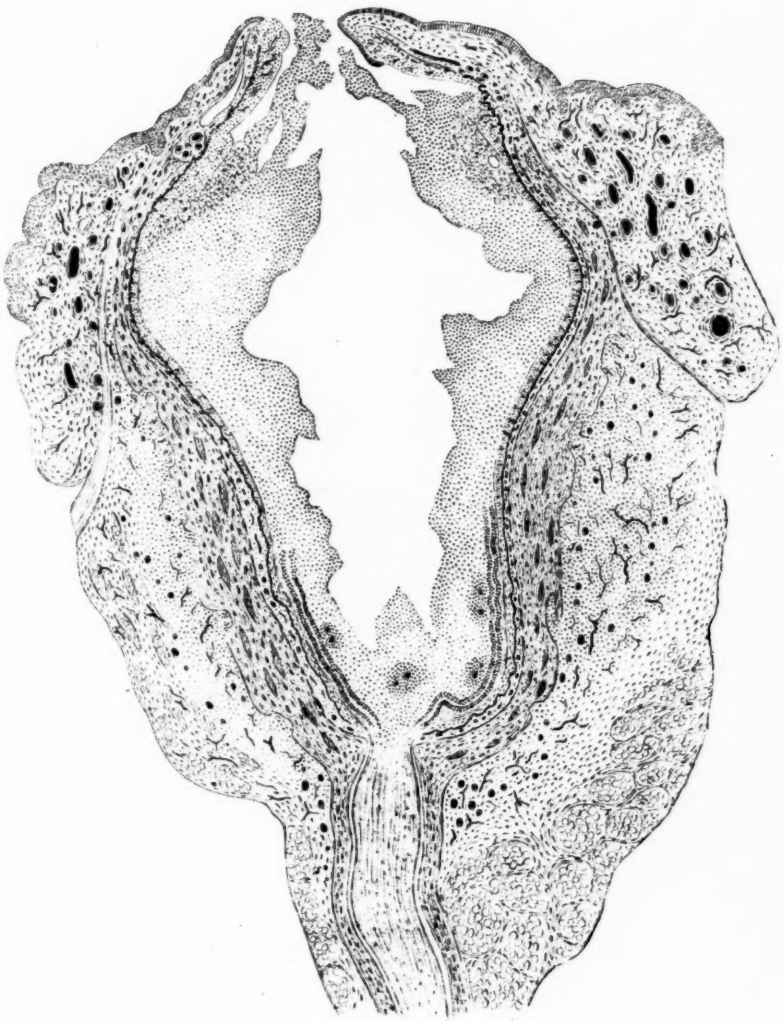


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Fig. 2.

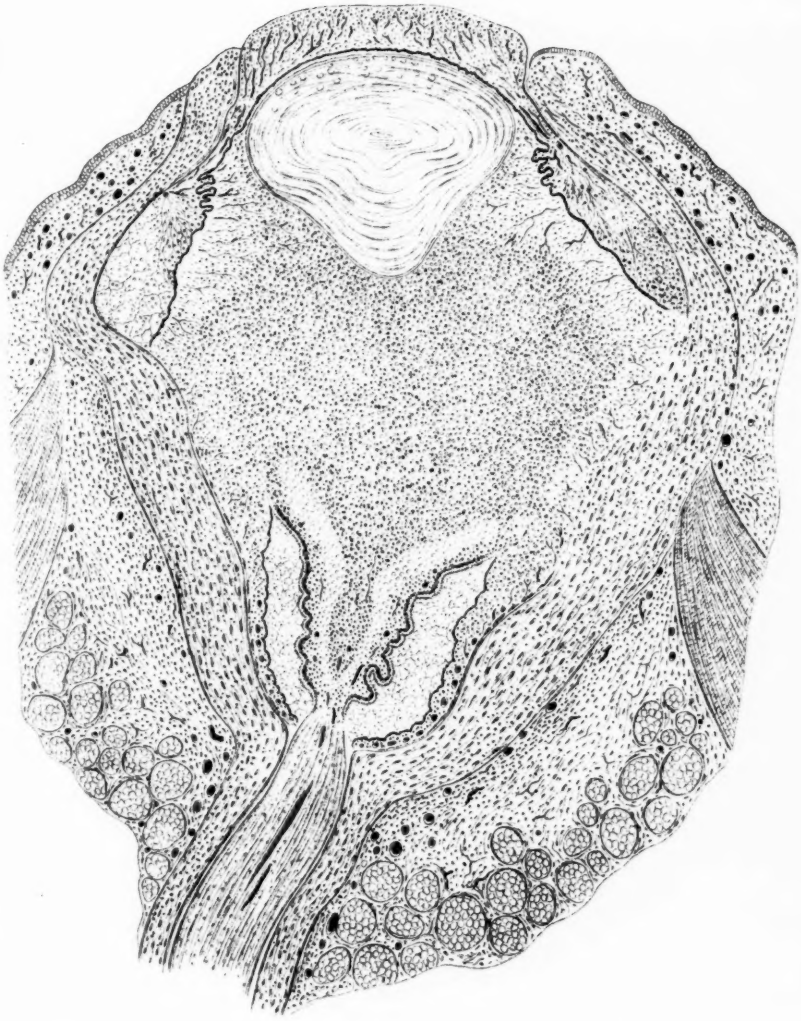

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Fig. 3.

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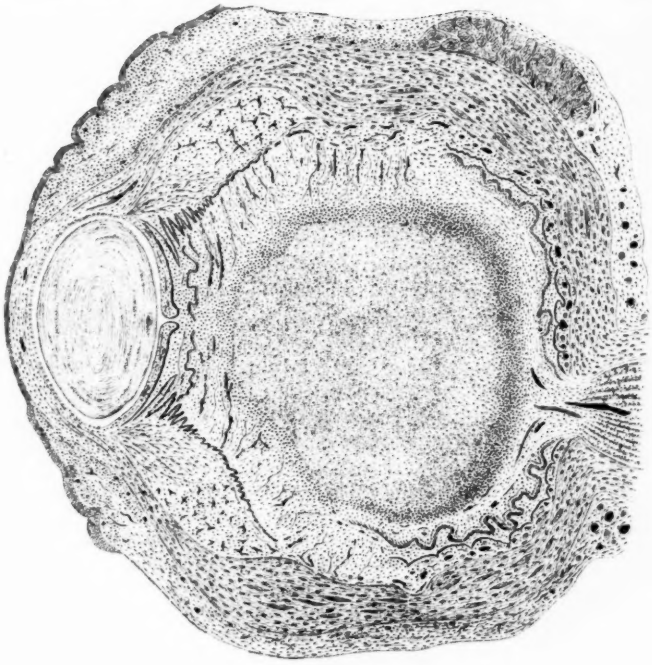

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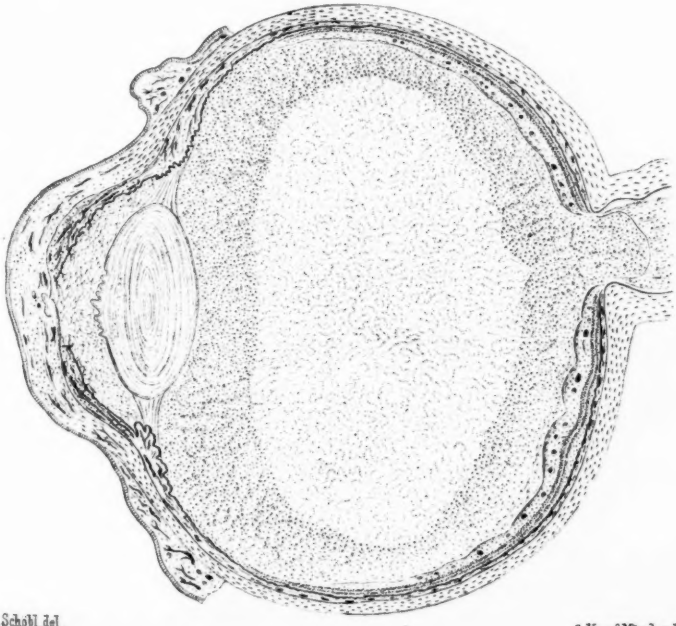

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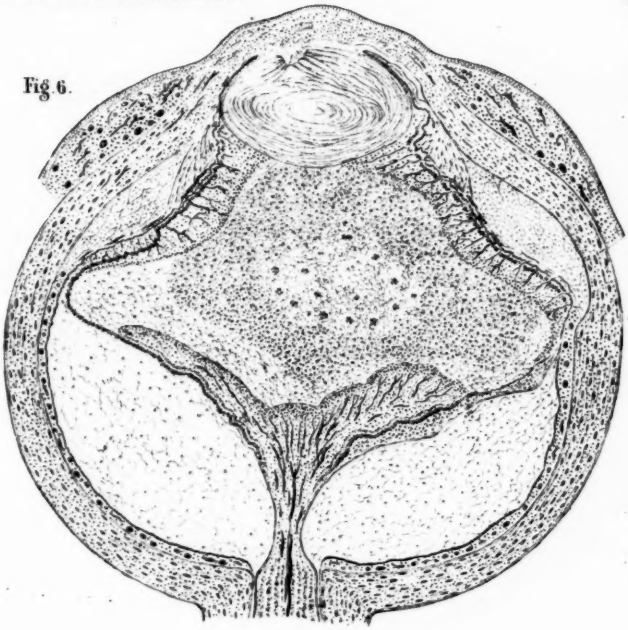

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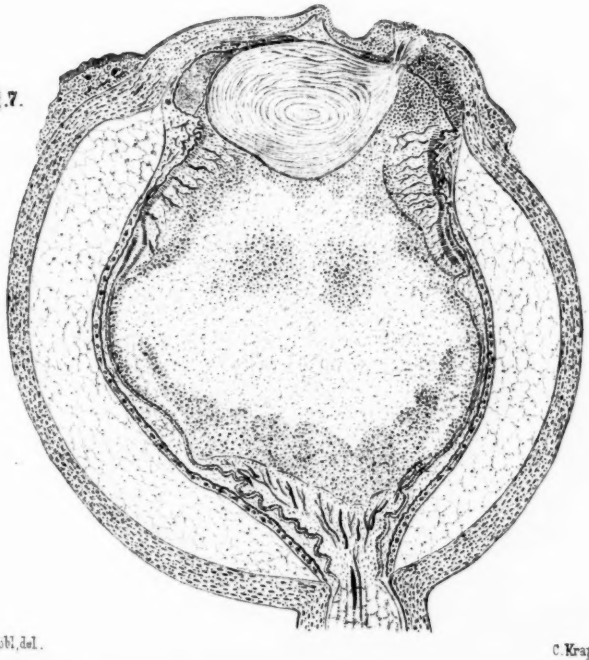

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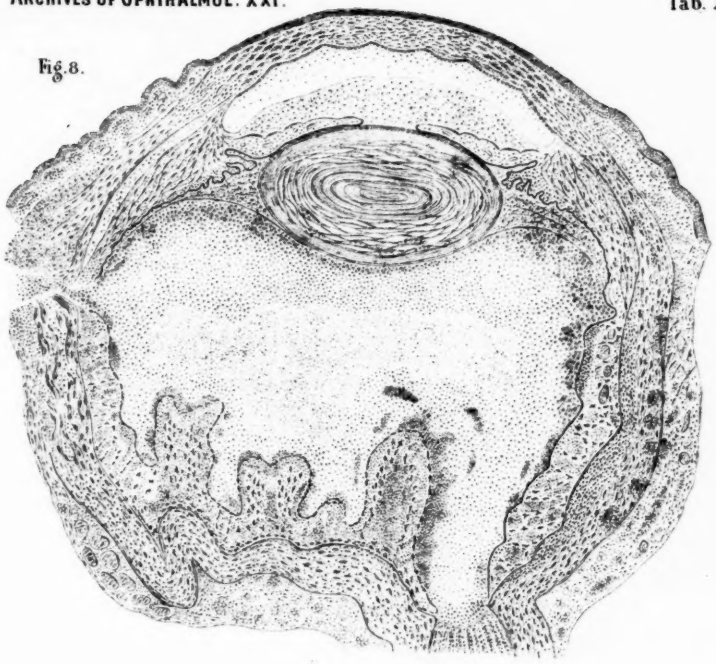
Fig. 8.



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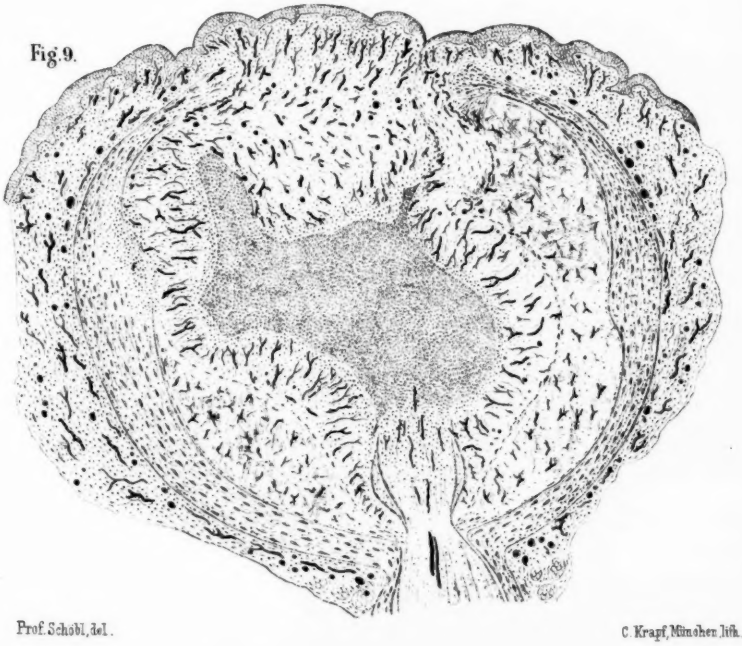

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